

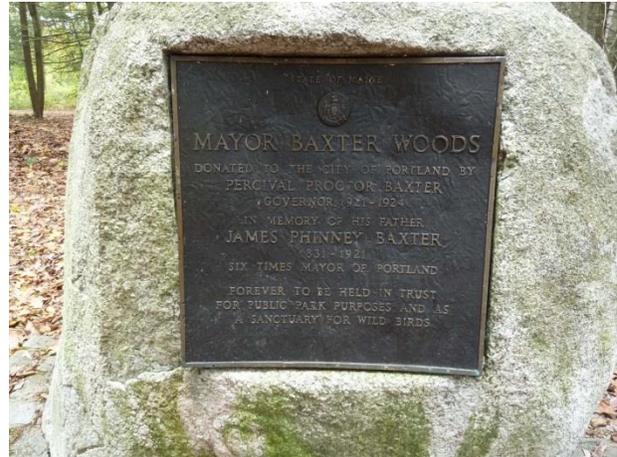
Forest and Wildlife Habitat Management Plan

for

Mayor Baxter Woods

Portland, Maine

Plan Date: May 18, 2018



Robert R. Bryan, LF# 907
Forest Synthesis LLC
271 Harpswell Neck Road
Harpswell, ME
rbryan@forestsynthesis.com

Forest Synthesis LLC

*Forest Management, Ecology, and
Certification*

www.forestsynthesis.com

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Introduction

Mayor Baxter Woods is a unique late successional forest located in the heart of the City of Portland that was donated to the City by Governor Percival Baxter in 1946 “...for the benefit of the people of Portland public recreational and educational purposes...” that “ shall forever be kept in its natural wild state and as a sanctuary for wild birds...”

At the request of the City of Portland Parks and Recreation Department, Forest Synthesis, LLC has prepared an ecological assessment and management plan based on the principles laid out in Governor Baxter’s deed. Key components of this project include assessment, mapping, of and recommendations for:

1. Natural ecosystems, including wildlife habitats based on forest type, age, structure, as well as non-forest habitats,
2. Other natural features, including wetlands, streams, vernal pools,
3. Forest health concerns, including invasive plants, insects, and disease,
4. Cultural features and human use, including historic features, trails, and a qualitative assessment of impacts associated with recreational use,
5. Protection, restoration and enhancement forest ecosystems and wildlife habitats, and
6. Ecological monitoring.

Management Goals and Objectives

Goals Based on Deed Restrictions

Based on Governor Baxter’s deed to the City¹, management goals for Mayor Baxter Woods (referred to hereafter in this report as MBW) include:

1. Use for public recreational and educational purposes, and
2. Keep the property in its natural and wild state and as a sanctuary for wild birds.

Restrictions associated with the deed that affect use and management include:

1. No streets for public conveyances and no cement walks, with only paths and trails for pedestrians,
2. Any trees that shall fall or that may become a menace to life may be removed, but no other trees therein shall be taken down;
3. Use solely by pedestrians; horses, automobiles and other motor vehicles are excluded, except those of the City used solely in caring for the woods.

Reconciling Current Uses and Deed Conflicts

In attempting to identify specific management actions that are compatible with the deed requirements, several issues have been identified.

- The deed requires that MBW be “used by said City in trust for the benefit of the people of Portland as a Municipal Forest and Park and for public recreation and educational purposes” and

¹ See Appendices for a summary of key deed restrictions

“shall forever be maintained for the sole use of pedestrians.” However, recreational uses conflict with the requirement that the forest be maintained as a “sanctuary for wild birds.” In particular, off-leash dogs are likely having a significant negative impact on ground-nesting and ground-feeding birds as well as those associated shrubs and small trees. A related concern is that the high density of trails and foot traffic adds to wildlife disturbance whether or not dogs are leashed. (see maps).

- Exotic (non-native) plant species identified as “invasive” by the Maine Natural Areas Program (MNAP) are altering the natural character in many places within MBW. The MNAP notes that because these plants can out-compete native species they are a direct threat to Maine’s natural and working landscapes. In addition, some exotic species not formally classified as “invasive” by MNAP are becoming well established in MBW. Because some of the invasive and exotic species are trees, the deed creates an internal conflict between the goal of maintaining the property in a “wild and natural state,” which implies that exotic species should be removed, and the restriction that trees that are a “menace to life may be removed, but no other trees therein shall be taken down.”
- Two species of exotic insect pests are found in the forest, notably elongate hemlock scale and hemlock wooly adelgid. Both insects kill hemlocks. While research into using predatory insects to control hemlock wooly adelgid shows some long-term promise, currently insecticides are the only effective control method to control with hemlock pest. Because of the widespread abundance of hemlock in MBW and in particular the dense hemlock midstory that characterizes much of the forest, maintaining all hemlocks may be impossible without repeated and widespread pesticide use. While tree mortality associated with native insects is a natural forest process, allowing widespread mortality of native tree from an exotic insect is not a “natural.....state” of the forest. Harvesting some of the midstory hemlocks threatened by these exotic insects would allow more light to reach the forest floor and encourage the establishment of other native tree seedlings. In the long run this would result in a more resilient forest of native species, but removing any hemlocks would conflict with the restriction on cutting of trees other than those that are hazardous.

Integrated Goals and Objectives

Clearly identified management goals and objectives are essential to guide management and to provide a framework for evaluating whether or not management outcomes are successful. The plan utilizes the following framework:

Goals: Broad generalizations about the future resource conditions that management is designed to culture. Goals are often long-term in nature and may also encompass values of interest to the landowner.

Objectives: Detailed descriptions, pertaining to a specific goal, of what the resource will look like or the management approaches necessary to achieve that goal. Objectives are often measureable and often are more short-term in nature than goals.

The goals and objectives below attempt to balance the internal conflicts within the deed by considering the long-term dynamics of the forest and its context within the surrounding cityscape. In addition, forest management goals that are not specifically mentioned in the deed but are considered to be a core

component of ecosystem management consistent with deed requirement that the forest be maintained “in a natural wild state and as a sanctuary for wild birds” are included.

1. Goal: Promote recreational uses that are consistent with maintaining the property in a wild and natural state and as sanctuary for wild birds

Objective:

- Reduce disturbance to forest birds from recreational use

Monitoring:

- Number and type of ground-nesting and understory birds using the forest

2. Goal: Maintain a natural ecosystem based on native plant and wildlife species and natural ecosystem processes

Objectives:

- Develop and implement a plan to control invasive plants and other non-native plants
- Develop and implement a plan to control non-native insects that currently or could in the foreseeable future threaten forest health (e.g. hemlock woolly adelgid, hemlock scale, browntail moth, winter moth)
- Allow late successional forest conditions, including large trees, canopy gaps, and understory regeneration, to develop naturally over time
- Maintain and enhance shrub and old-field habitat
- Restore degraded areas near property lines and along trails

Monitoring:

- Extent and density of invasive and other exotic plants
- Extent and density of non-native insects that threaten forest health
- Forest species composition, density, and tree size by major vegetation layer
- Extent and condition of shrub and old-field habitat
- Condition of restored areas

3. Goal: Protect soils and water quality

Objectives:

- Manage trails to minimize the area of soil compaction from pedestrians
- Minimize concentrated runoff from trails and associated impacts within MBW and lower in the watershed
- Ensure that ditches, culverts, and other components of the drainage system are designed to accommodate the increasingly intense rainfall events associated with climate change

Monitoring

- Condition of ground-layer vegetation adjacent to trails
- Condition and size of drainage structures relative to needs for large storm events
- Erosion and overflow within the drainage system

4. Protect City property from encroachment and inappropriate use

Objectives:

- Clearly mark all boundary lines with fencing or other means
- Restore areas where abutters are encroaching on City property
- Discourage unauthorized dumping of brush with appropriate signage

Monitoring:

- Condition of boundary lines
- Evidence of encroachment and unauthorized dumping

5. Goal: Promote educational uses consistent with the MBW deed

Objective:

- Develop educational programs and materials that emphasize the natural ecosystem and wildlife values of MBW

Monitoring:

- Number and type of educational programs and number of different audiences

Management Plan Summary

Table of Cover Types and Land Uses

The following table summarizes major cover types (forest/non-forest) and land uses. More detailed cover type information and descriptions are included in later sections of the report.

Cover Type/Land Use	Area (acres)
Deciduous forest	5.57
Coniferous forest	1.03
Mixed forest	22.98
Meadow/shrub	0.87
Shade tree/mown grass	1.47
Pond	0.22
Parking	0.10
Abutter encroachment	0.22
Total	32.46

Summary of Past management

Dates	Management Activity
1947-48	Individual risk tree removal to reduce per direction of Percival Baxter
49-50	Red pine planted with help of Deering High School students near Forest Avenue
1989-90	Some individual tree work (risk tree removal, etc.)
2004	Red pine thinning per direction of Maine Forest Service District Forester Dennis

Late 1990's to early 2000's	Brennan	Removal of large Norway maple along Stevens Ave and near old home site
2000-present		Removal of Norway maple along Hartley Ave and control of Japanese barberry, multiflora rose, and Japanese knotweed.

Summary of Management Recommendations - 2016-2025

Following is a summary of activities included in the later sections of the report. Please refer to the Individual Stand Descriptions and Recommendations and other referenced sections for additional details on implementing the recommendations. Management recommendations included in this plan represents the opinion of Forest Synthesis based on the forest ecosystem assessment, restrictions spelled out in the MBW deed, and consultations with City and outside experts.

- Final decisions on which management actions to take and when to implement them will require further consideration by the City.
- Detailed plans for most of the recommended activities should be prepared before implementation, and the results of management should be monitored as needed.
- Recommendations below are prioritized. Priority 1 items are considered to be most important and should be undertaken first.

Stand or Area	Priority/Timing	Recommendations <i>(This is a summary only - see applicable management plan sections for details.)</i>	Management Plan Sections
All	1	Develop and implement a plan to control and monitor invasive plants as well as other aggressive non-native plants.	<i>Invasive Plants</i>
All	1	Develop and implement a plan to protect hemlock, red pine, and oaks from exotic insects and diseases that threaten these species in Maine. Highest short-term priority should be focused on mapping and protecting the old hemlock legacy trees in found throughout the forest.	<i>Insects and Disease; Stand Descriptions and Management Recommendations</i>
11, F4	1	Many properties on Hartley Street are encroaching onto City property. Where MBW abuts residential properties the City should clearly mark the boundary with fencing or multiple posts and signs and work with abutters to restore degraded city property to a natural condition. Signs should be placed a various points along other boundaries and access points.	<i>Boundary Lines</i>
All	1	Recreational uses, and in particular unleashed dogs, are likely having and adverse impact on ground-nesting and ground-feeding birds. Because the Baxter deed requires that the City maintain Baxter woods for recreational use and as a sanctuary for wild birds, the city should require that dogs be leashed. The city could consider closing some minor trails to create wider spaces between trails and thus minimize disturbance of wildlife.	<i>Recreational Use</i>
F1-F4	1	Develop and implement a site planting and maintenance plan that includes a) planting shrubs and wildflowers for wildlife food and cover as described in the <i>Stand Descriptions and Management Recommendations</i> for each area, and b) maintaining the wildlife habitat provided by these existing open/shrub areas by periodic	<i>Distribution of Habitat Types and Development Stages; Stand Descriptions and Management</i>

		brush mowing; cutting encroaching trees would also be beneficial but apparently is not allowed per deed restrictions.	<i>Recommendations</i>
All	1	The City should have a legal and policy review to decide under what circumstances trees may be cut in MBW.	<i>Reconciling Current Uses and Deed Conflicts</i>
All	1	Monitor the results of management actions and make corrective actions as needed. Annually monitor breeding birds, vernal pools, insects and diseases, invasive plants, condition of trails, boundary lines, and recreation use.	<i>Monitoring</i>
1	2	Thin the red pine plantation and allow natural regeneration to develop. The goal is to promote the best trees, develop understory wildlife habitat, and reduce risk from insect and disease.	<i>Stand Descriptions and Management Recommendations</i>
10	2	Remove all Norway maple and plant native species in conjunction with drainage improvements near Forest Avenue	<i>Stand Descriptions and Management Recommendations</i>
Trails	2	Review all trails and develop and implement a trail management and maintenance plan to minimize erosion, runoff and soil compaction, restore a more natural character, and restore historic landscaping.	<i>Trails</i>
All	2	Allow dead, dying trees, and downed trees and limbs to remain in place unless they represent a threat to trail users, and scatter downed limbs that fall on trails within the forest rather than chipping them.	<i>Wildlife Trees, Dead and Downed Wood, and Retention Patches</i>
1-10	2	The City has limited options to enhance habitat for birds and other wildlife due to the deed restrictions that do not allow tree cutting. In forest areas, allow late successional forest conditions, including large trees, canopy gaps, and understory regeneration, to develop naturally over time.	<i>Distribution of Habitat Types and Development Stages</i>
VP1, VP2	3	Consider enhancing the vernal pools to create more natural contours or a longer period when water is present, as described in the recommendations.	<i>Vernal Pools</i>
n/a	3	Compile historical and archaeological information from the Buttrick study and other sources to create a more complete and accurate history and maps of land use at MBW. These could be used for educational purposes and as a record for long-term management.	<i>Historical, Cultural, and Archaeological Sites</i>
5a	4	Removing some of the midstory hemlock in other parts of this stand would proactively reduce risk of hemlock loss while enhancing wildlife habitat by promoting understory and ground cover plant layers. However, this does not appear to be allowable under the deed restrictions.	<i>Distribution of Habitat Types and Development Stages ; Stand Descriptions and Management</i>

Maps



Notes:

Base map: Google Terrain

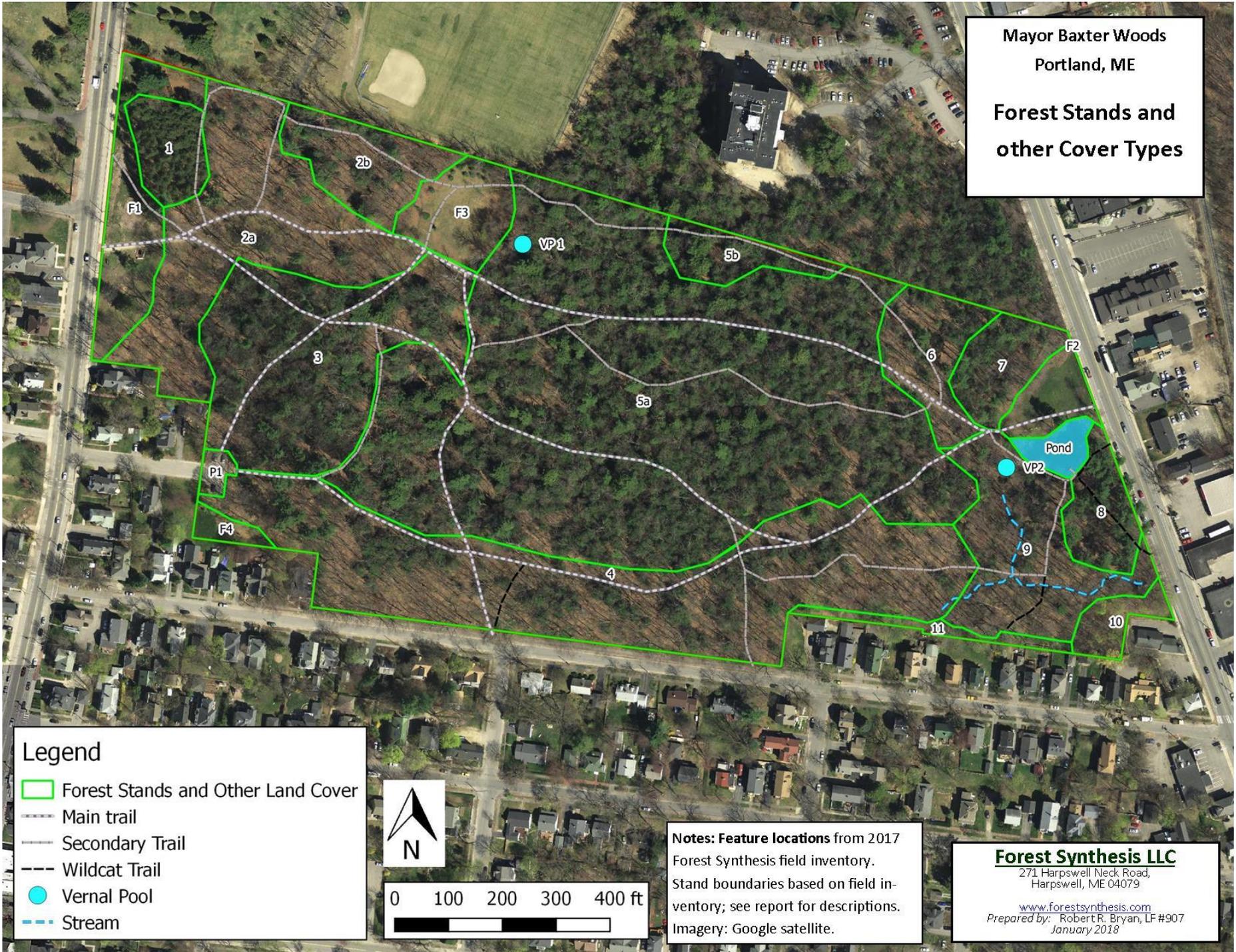
Forest Synthesis LLC

271 Harpswell Neck Road,
Harpswell, ME 04079

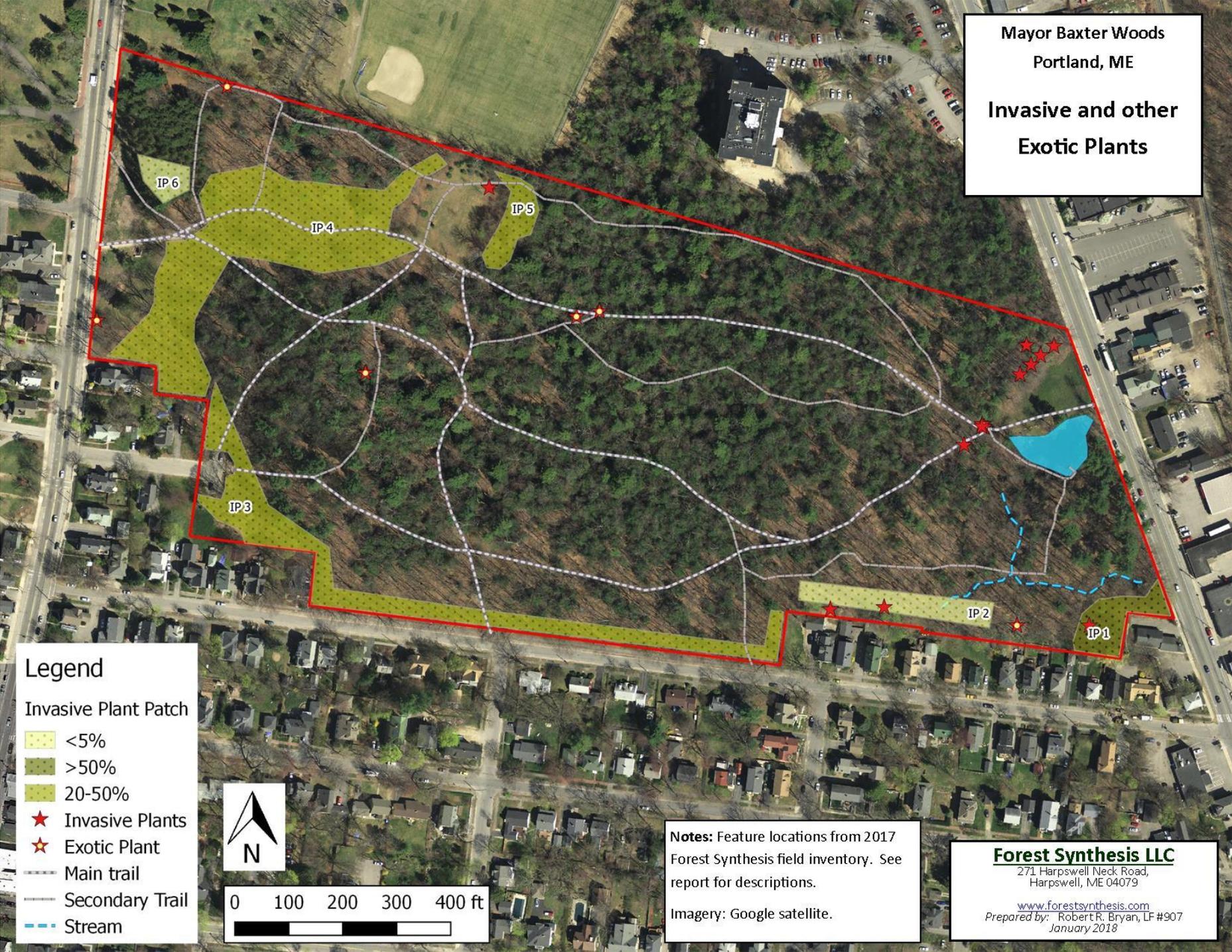
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Prepared by: Robert R. Bryan, LF #907
January 2018

Mayor Baxter Woods
Portland, ME
Forest Stands and
other Cover Types



Mayor Baxter Woods
Portland, ME
Invasive and other
Exotic Plants



Legend

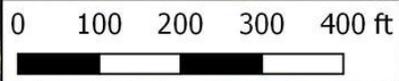
Invasive Plant Patch

- <5%
- >50%
- 20-50%

★ Invasive Plants
★ Exotic Plant

--- Main trail
--- Secondary Trail

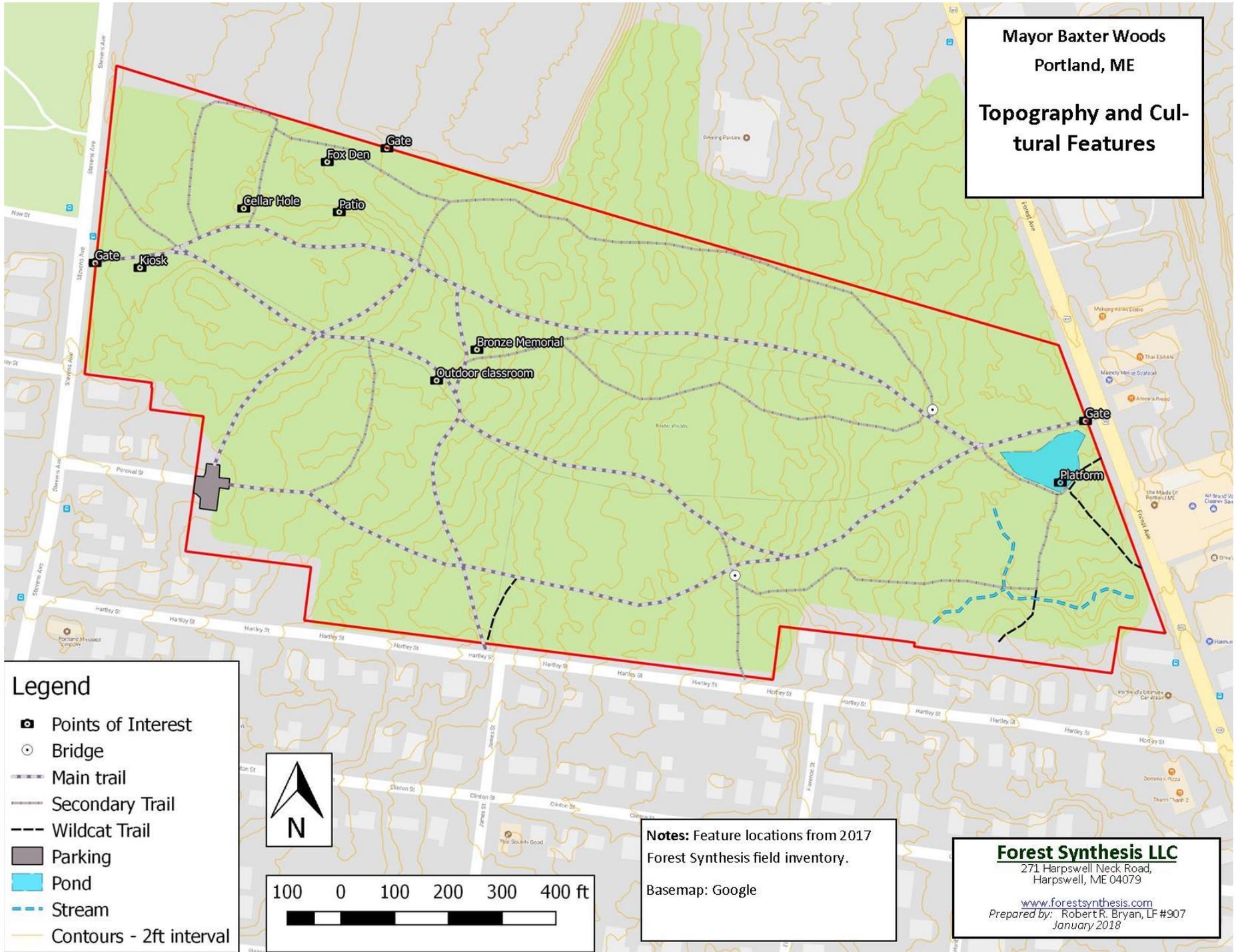
- - - Stream



Notes: Feature locations from 2017 Forest Synthesis field inventory. See report for descriptions.
Imagery: Google satellite.

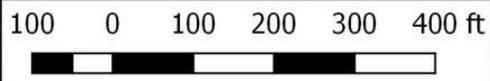
Forest Synthesis LLC
271 Harpswell Neck Road,
Harpswell, ME 04079
www.forestsynthesis.com
Prepared by: Robert R. Bryan, LF #907
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**Mayor Baxter Woods
Portland, ME
Topography and Cultural Features**



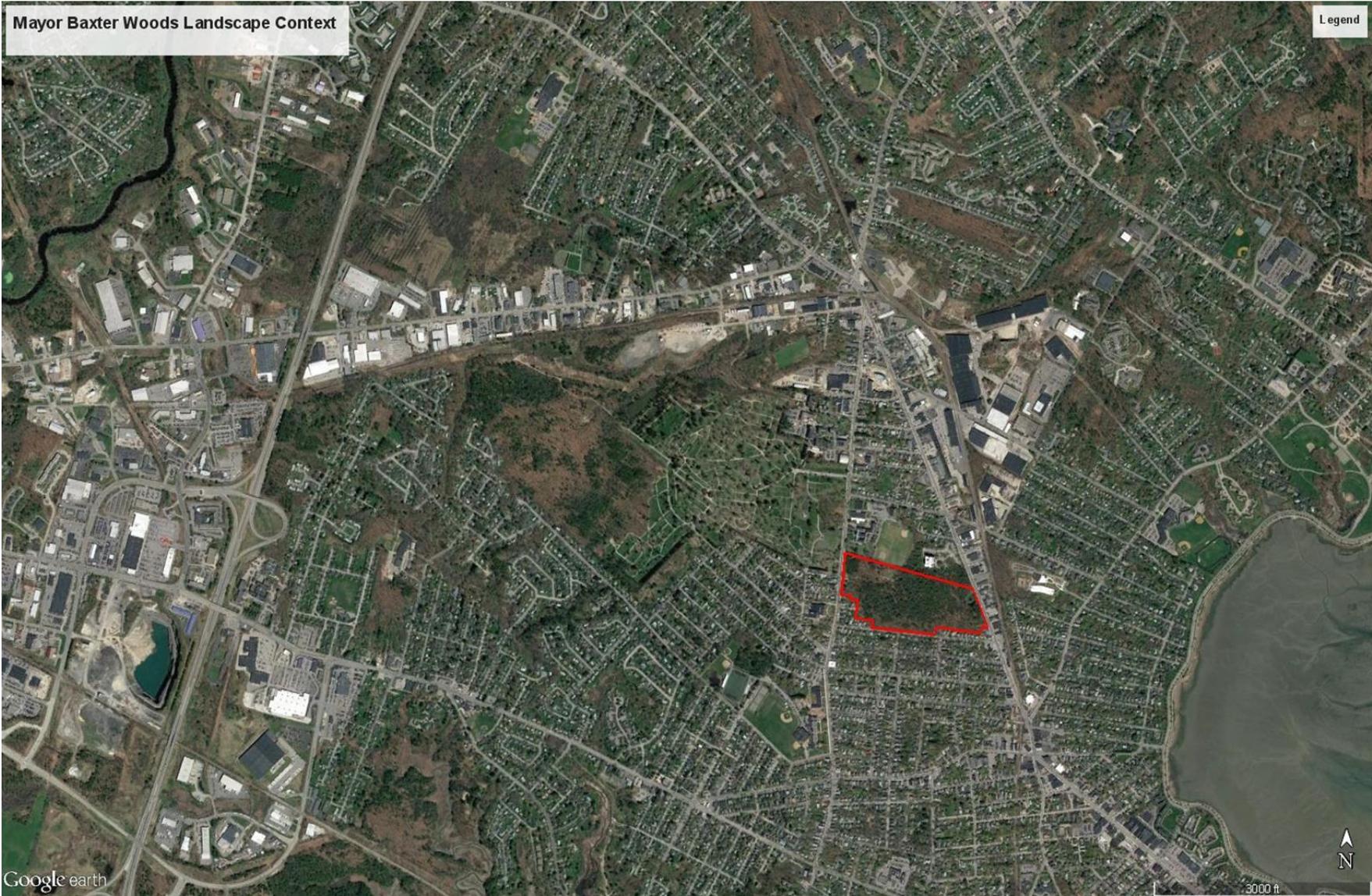
Legend

- Points of Interest
- Bridge
- Main trail
- Secondary Trail
- Wildcat Trail
- Parking
- Pond
- Stream
- Contours - 2ft interval



Notes: Feature locations from 2017 Forest Synthesis field inventory.
Basemap: Google

Forest Synthesis LLC
271 Harpswell Neck Road,
Harpswell, ME 04079
www.forestsynthesis.com
Prepared by: Robert R. Bryan, LF #907
January 2018



Notes:
Imagery source: Google Earth

Forest Synthesis LLC
271 Harpswell Neck Road,
Harpswell, ME 04079
www.forestsynthesis.com
Prepared by: Robert R. Bryan, LF #907
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Property Description

General Forest Description

Mayor Baxter Woods is located between Forest Avenue and Stevens Avenue in the Deering section of Portland (see Locus Map). The property is predominantly forested and characterized by old stands of red oak, white oak, white pine, hemlock and other species. With dominant canopy trees 180-200 years in age and untouched in over 100 years of age, the average size and age of the trees is extremely rare. As an example of old oak-pine-hemlock forest Baxter Woods may be without par anywhere in Maine.

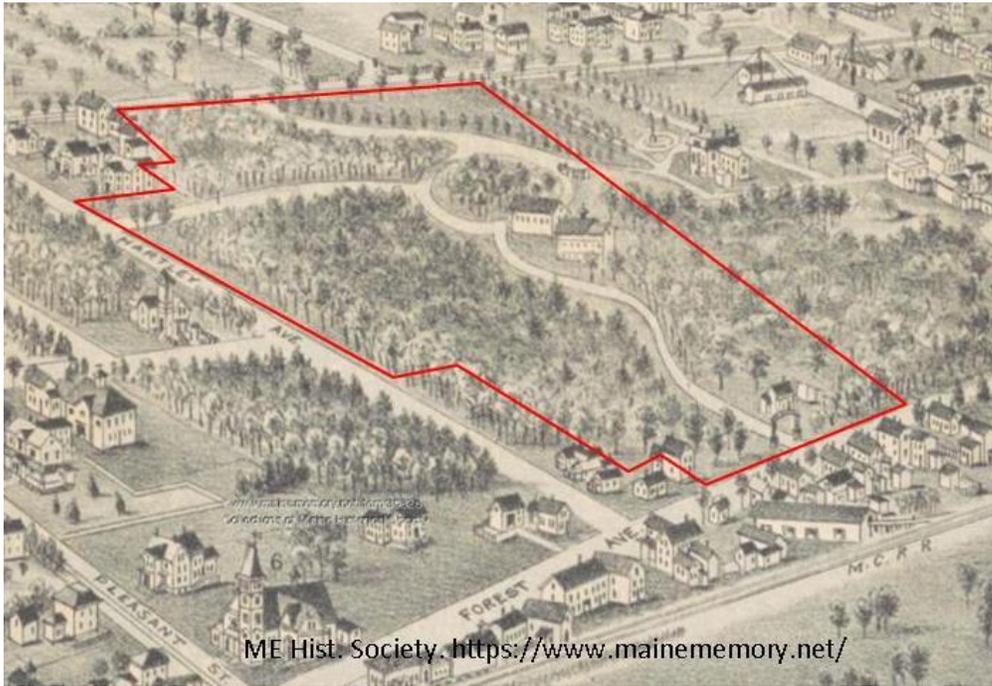
The terrain slopes gently in an easterly direction from Stevens Avenue to Forest Avenue. The soils originated as sandy outwash from glacial streams during the last ice age and range from excessively well-drained sands in the west to moderately well drained with a few somewhat poorly drained and poorly-drained pockets to the east. Intermittent seasonal water coursed and small streams drain to the east.

MBF is located in the Casco Bay watershed and drains to Back Cove, which is located short distance to the east.

Property History

Woodlands in this region were cleared for farming beginning in the late 1700's after the Revolution and into the 19th century, with abandonment of marginal farmland beginning in the latter half of the 19th century. Most of what we see as forest today in southern and central Maine was formerly farm field and pasture.

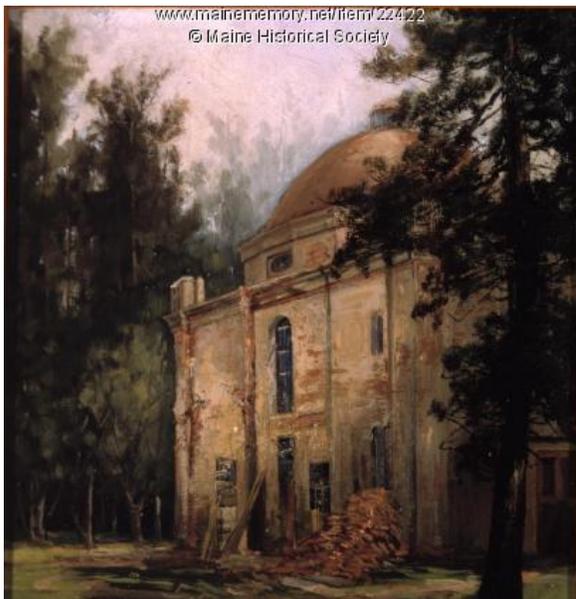
At MBW, smooth soil surfaces in the western third of the woods (Stand Map areas 1, 2a, 2b, 3, F1 and F3) and near Forest Avenue (areas 7, 8, 9 and F2) indicate that these areas were plowed at one time. Pit-and-mound soil topography is found on the remainder of the property. Pit-and-mound (or "pillow-and-cradle") topography develops over hundreds of years as forest trees tip over with age or wind and the root mass decays, leaving a mound where the root mass and uprooted soil were deposited and a shallow depression where the root mass once anchored the tree. Because pit-and-mound topography is smoothed out when former forest soils are plowed, its presence indicates that most of the central part of the property (Stand Map areas 4, 5a, 5b, and 6) was ever plowed, but it could have been partly cleared for pasture and or have been part of a farm woodlot. The presence of very old hemlock in the middle of the property is another sign that this area has always been wooded.



Baxter Woods was once part of the estate of F.O.J Smith, whose mansion “Forest Home” occupied the area near Stand F3 (see Stand Map)² from 1836 until the late 1800’s or early 1900’s. The mansion was surrounded by large trees at the time that Harrison Bird Brown painted the scene in 1880-1881³. While it is likely that Mr. Smith may have cut some trees for forest health and aesthetics, the size and apparent age of some of the overstory trees suggest that the forested areas were largely undisturbed during his tenure. This is confirmed by

1843 aerial map of Deering with current boundary of Mayor Baxter Woods outlined. “Forest Home” is located approximately where Stand Map area F3 is located today.

the 1886 Birds-eye View of Deering (Maine Historical Society, www.mainememory.net), which depicts mature forest in the eastern two-thirds of MBW (see image). The same map shows young forest and/or planted trees near Stevens Avenue, which confirms the likelihood that that the western third of the property was cleared and plowed at one time.



This painting of the Forest Home library c. 1839 also confirms that Baxter Woods had many mature trees at that time.

The same hands-off management continued after the estate was sold to James Phinney Baxter in 1878. The Stevens Avenue kiosk notes that oldest tree in Mayor Baxter Woods dates from 1807. One white oak stump observed in 2017 and estimated to have been cut about 5 years previously had approximately 185 annual rings (rough field count), suggesting the tree was established sometime around the 1830’s.

The red pine grove (Stand Map, area 1) was estimated to be planted in 1949 according to a resident who remembered both Baxter Pines and Baxter Woods planted with seedlings that involved Deering High School students and State of Maine plant stock. The stand was thinned in 2004 with advice from Dennis Brennon, the Maine Forest Service District Forester at the time.

² See the brochure *Welcome to Baxter Woods* for a more extensive ownership history beginning with F.O.J. Smith.

³ The estate was sold to James Phinney Baxter in 1878, so presumably the painting was commissioned by the former mayor Baxter as it is owned by the City.

Access

MBW has excellent access from Forest Avenue, Stevens Avenue, and Hartley Street for public recreation and for any management that might occur. The main trails provide a network of interior access. There is currently only one small fence opening on the north boundary, but a new gate is proposed for that area

Interaction with Surrounding Properties

Single family residential homes are located adjacent to the south and southwest. Multi-unit residential properties and playing fields are located to the north, commercial properties across Forest Avenue to the east and Evergreen Cemetery across Stevens Avenue to the west.

Legal Obligations

The principal legal obligations are the Baxter deed described in the introduction. Maine's laws applicable to timber harvesting and water quality protection, pesticide use, as well as municipal ordinances also apply. Because the City has an active urban forestry program and is familiar with legal requirements these will not be described in greater detail in this plan. Prior to any site disturbing activities, check with the City planning department, Maine Forest Service, and Maine DEP, or other applicable agencies (e.g. Maine Board of Pesticide Control) for the most recent applicable regulations.

Forest Ecosystem Planning and Management

The following sections describe ecological resources of importance and include recommendations to protect their values, Soil and Water Quality Protection, Management for Fish, Wildlife, and other Biodiversity, and Planning for Climate Change. Other management recommendations to achieve specific management objectives are included in later sections of this plan.

Soil and Water Quality Protection

Soils

Identification and Significance

Soils are critical to the long-term ecological health of the forest and a key factor in determining the species of trees and other plants that may be present. Most soils can be readily damaged by heavy equipment when soils are wet after rains and during the spring and fall mud seasons. Wetter sites may have very short windows for forest management activities and may be limited to either winter operations on frozen ground conditions or to dry periods at other times of the year.

A Natural Resource Conservation Service (NRCS) “Web Soil Survey” report for Baxter Woods was prepared for MBW (see Attachments). The field reconnaissance confirmed that NRCS mapping showing excessively well-drained sands in the west to moderately well drained with a few somewhat poorly drained fine sandy loams and poorly-drained pockets to the east. These soils are excellent for pine, oak and hemlock and are important factor in why these species are so prevalent today.

Trails

Current Conditions

The location of trails is shown several of the maps. Trails were classified into three major for the purposes of this plan:

Main trails: Gravel base, 10-15 foot width with culverts and ditching as needed, suitable for vehicular use.

Secondary trails: Footpaths 3-5 feet in width, natural soil base, not suitable for vehicular uses

Wildcat trails: Non-maintained trails established by customary pedestrian use

Some areas of slight surface erosion were noted on some the main trails, especially in Stand 4. The riprap ditch along the main trail in the eastern half of Stand 4 has been identified by the City as a possible area of improvement to restore a more natural character to the trail. Several of the main trail intersections have become very wide as result of walkers who cut the corner when going from one trail to the next.

Recommendations

Review all trails and develop and implement a trail management and maintenance plan with the following components:

- Ensure that the crown on main trails is sufficient to effectively and rapidly shed surface runoff;

- Minimize ditching by using changes in slope, ditch turnouts, and cross-drain culverts as needed to direct water into adjacent forest areas where it will infiltrate into the soil rather than be concentrated in an artificial drainage system;
- Replace and upgrade culverts as needed to ensure that they are capable of handling more intense rainfall occurring as a result of climate change (e.g., historically “50-100 year” storm events);
- Apply other applicable guidelines for roads and trail in **Best Management Practices for Forestry: Protecting Maine’s Water Quality** (“BMPs”; see *References* section) to protect soil and water quality;
- Use appropriate landscaping to minimize soil compaction and widening of the main trail junctions;
- Restore the historic stone work along the main trails;
- Manage secondary trails using the guidelines in the **Recreational Trail** section of the Appendices;
- Close most wildcat trails by placing brush and/or signage as needed;
- Refer to the *Recreation Use* section later in this report for recommendations related to trail management and related impacts on plant and wildlife habitat.



Lack of defined trail edges is leading to soil compaction and loss of vegetation at main trail junctions

Water Quality

- Always apply Maine’s **Best Management Practices** for water quality protection when disturbing soils or cutting trees.
- See *Aquatic Habitats and Riparian Zones* for other fish and wildlife habitat protection measures.

Management for Wildlife, Fish and Other Biodiversity

Introduction

This plan includes an assessment of current wildlife habitat conditions to use as a baseline against which to measure progress towards its long-term wildlife management goals. The habitat assessment methodology is based on and Maine Audubon's **Foresters for Maine Birds** (publication pending) and information on non-avian species from **Focus Species Forestry, a Guide to Integrating Timber and Biodiversity Management in Maine** (Bryan 2007) While both of these documents are geared towards landowners and managers with an interest active forest management program, the assessment methodologies are well suited to MBW's goal to maintain the forest in a natural conditions as a sanctuary for wild birds.

Forest Classification

The basic building block used for forest wildlife habitat assessments and management planning is the forest stand, which is an area that is generally similar in terms of vegetation cover type (species mix of dominant vegetation), age-class distribution, and site quality. Some stands may be very uniform in size and species composition (for example a stand of even-aged white pine) while others may be composed of patches of different species and ages (for example, an uneven-aged hemlock-hardwood forest). Stands may vary from a few acres to over 100 acres in size. For this property, aerial photography and field data were used to divide the forest into stands and to create the *Stand Map*.



Forest age, structure and type are key determinants of wildlife habitat. The young forest of shrubs and saplings above at Baxter Woods area F3 may be used by birds such as eastern towhee and chestnut-sided warbler, while older forest areas like this oak-hemlock forest type (Stand 5b) will attract birds such as Blackburnian warbler and black-throated blue warbler.

Forest Habitat Types

For habitat assessment purposes, common forest types found on the property have been grouped into Forest Habitat Associations, which generally share a common suite of wildlife species in any given region. The **Foresters for Maine Birds** habitat associations are described in the following table.

Forest Habitat Classification

Map Symbol	Forest Habitat Association <i>(comments in italics)</i>	Common Forest Types	Baxter Woods
NHW	Northern Hardwoods¹ <i>May include up to 25% softwoods</i>	Northern Hardwoods (beech-birch-maple and variants) Aspen-Birch (early successional variant)	No
NMW	Northern Mixedwoods² <i>Neither hardwoods nor softwoods exceed 75% of stocking</i>	Northern Hardwood/Hemlock Northern Hardwood/Spruce-Fir Hemlock (in patches) Aspen-Birch (early successional)	No
NSW	Northern Softwoods³ <i>May include up to 25% hardwoods</i>	Spruce-Fir Spruce-Hemlock White Pine-Mixed Conifer Northern White Cedar Aspen-Birch (early successional)	No
OP	Oak-Pine⁴ <i>May range from pure oak-dominated hardwoods to mixed hardwood and softwood stands</i>	Northern Red Oak Red Oak-Mixed Hardwoods Red Oak-White Pine-Red Maple White Pine Hemlock and Hemlock-Oak-Pine	Yes
MHW	Mixed Hardwoods	Oak-Northern Hardwoods Oak-Aspen-Birch	Yes

Habitat Age Class, Stand Structure Class, and Canopy Cover

Many wildlife species are closely linked to specific forest ages and structures, including tree size, canopy density, and vertical structure (i.e., canopy layering), and timber management options are also age and size related. Stands are classified in terms of general size and combinations of stand structure class (which is related to maturity) and canopy cover as described in the following tables. **Stand Structure Class** is an indication of ecological development, wildlife habitat condition, and commercial forestry potential. **Habitat Age Class** is used to summarize the stand structure classes into broad habitat conditions for assessment and planning.

Forest Habitat Age and Structure Classes			
Habitat Age Class	Stand Structure Class ¹		Description ²
Young	1	Regeneration	1-10 years old, <1" DBH ⁴
	2	Sapling	2-5" DBH, 10-30', <30% overstory ³ cover
Intermediate	3a	Intermediate - Single-aged (Poletimber)	Overstory 5-10" DBH, total canopy cover > 60-70% with midstory component <30%
	3b	Intermediate - Two-aged (Poletimber)	Overstory 5-10" DBH and <60% cover, development of midstory and understory variable depending on time since last harvest or other canopy disturbance
Older	4	Maturing (Small Sawtimber)	Overstory trees 10-16" DBH dominant, total canopy cover typically >60-70%
	5	Older Complex (Large Sawtimber)	Overstory trees >16" DBH dominant. Multiple canopy layers common with total canopy cover typically >60-70%

¹Equivalent forest product classes in parentheses.

²These are general descriptions; diameter and canopy cover may vary by species and site. Percent cover of any layer may be less than indicated if there has been recent harvesting (typically within 10-15 years)

³See Vegetation Layer table

⁴DBH: diameter at breast height (4.5 ft.)

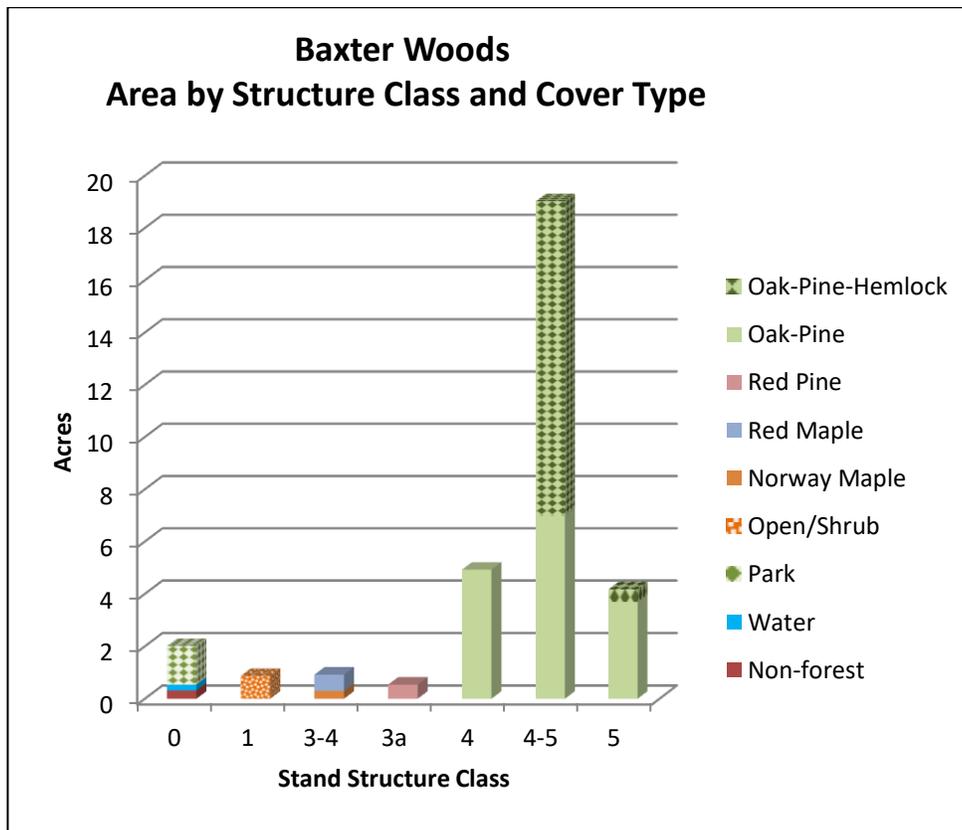
Vegetation Layer		Height (ft.)	Bird Habitat Notes
Canopy	Overstory	>30	Canopy heights of >50-60' are important for many mature forest species, including Black-throated Green Warbler and Blackburnian warbler.
	Midstory	6-30	Important nesting and foraging stratum for species like Canada Warbler that prefer dense midstory. Other species, such as Eastern Wood-Pewee, prefer a more open midstory.
Understory		1-6	Important feeding and nesting cover for mature-forest species such as Black-throated Blue Warbler and Veery.

Canopy Cover Classes

Cover Class	% Canopy Cover
A	>80
B	60-80
C	30-60
D	5-30
E	<5

Distribution of Habitat Types and Development Stages

The distribution of forest habitat type and associated development classes as well as other cover types on the property are summarized in the following chart.



Stand Class	Area (acres)	Percent
0	2.01	6.2%
1	0.87	2.7%
3-4	0.92	2.8%
3a	0.54	1.7%
4	4.92	15.2%
4-5	19.02	58.6%
5	4.18	12.9%
TOTAL	32.46	100.0%

Forest Canopy Layers					
Stand Number	Type	Stand Structure Class and % Cover			Acres
		Overstory	Midstory	Understory	
1	Red Pine	3a/B	0	1E	0.54
2a	Oak-Pine	5B	2-3D	1B	2.85
2b	Oak-Pine	4-5B	2C-	1-2C	0.92
3	Oak-Pine	3-5B	3C	1E	3.12
4	Oak-Pine	5A	2C	1D, C	5.47
5a	Oak-Pine-Hemlock	5B	2-3B	1D,C	12.04
5b	Oak-Pine-Hemlock	5C	2-3C	1D	0.49
6	Oak-Pine	4-5A	2-3C	1D	0.84
7	Red Maple	3-4A	2D	1C	0.62
8	Oak-Pine	4-5A	2C	1B	0.59
9	Oak-Pine	4-5B	2C	1C	1.80
10	Norway Maple	3-4A	2D	1C	0.30

11	Non-forest				0.22
F1	Park	2-4C	0	0	1.06
F2	Park	2D	0	0	0.41
F3	Open/Shrub	n/a	n/a	n/a	0.72
F4	Open/Shrub	n/a	n/a	n/a	0.15
Pond	Water	n/a	n/a	n/a	0.22
P1	Non-forest	n/a	n/a	n/a	0.10
					32.46

Current Conditions

The preceding chart and table show that older stands (Classes 4 and 5) account for over 81% of the forest area, and exceptionally large proportion for any forest in Maine. Nearly all stands have moderate to full canopy cover of mature trees. Midstory is generally moderate, and understory is moderate to low. Extensive area with limited to no understory can be easily observed while walking the trails, especially in the middle third of MBW. To a large extent this is caused by the very dense hemlock midstory in these stands, which limits the light available for forest regeneration. While attractive from a visual perspective, the lack of understory cover limits the habitat for species that nest and forage in the lower canopy layers. Old field, shrub, and young saplings, and important habitat type for some species, represent less than 3% of the area.

Recommendations

Specific to forest age and structure, the City has limited options to enhance habitat for birds and other wildlife due to the deed restrictions that do not allow tree cutting.

- In all stands except open/shrub areas, allow late successional forest conditions, including large trees, canopy gaps, and understory regeneration, to develop naturally over time. Tree mortality from wind events, ice storms, and native insects and diseases will result in canopy gaps that will allow establishment and development of the understory and ground cover plants and habitat for birds that use these areas. While a systematic plan should be developed and implemented to protect a significant portion of the oldest hemlocks from the exotic hemlock wooly adelgid (HWA) and outbreaks of hemlock scale (see *Insects and Disease* section later in this report), allowing these pests to go untreated in some patches will result in an increase the light reaching the forest floor in those areas and stimulate growth in the understory.

Rare, Threatened, and Endangered Species, Natural Communities, and Significant Wildlife Habitat

Information on known locations of rare, threatened and endangered species, Significant Wildlife Habitats, and rare or exemplary plant communities was provided by the Maine Natural Areas Program (MNAP). Beginning with Habitat (BWH) maps prepared by the Maine Department of Inland Fisheries and Wildlife (MDIFW) in cooperation with the Maine Natural Areas Program (MNAP) were also reviewed.

Current Conditions

The Beginning with Habitat maps and MNAP report do not show any high-value plant and wildlife habitats in or near Baxter Woods. The nearest mapped features are in Back Cove and on the Fore River.

- The Forest Synthesis field assessment did not identify any areas that would be classified as Significant Wildlife Habitats by MDIFW.
- A systematic survey for rare, threatened, or endangered plants and animals was not part of the Forest Synthesis assessment, but given the location and type of habitats present the presence of these species is highly unlikely.
- Forest stands 2, 3, 4, 5, and 6 have dominant canopy trees 180-200 years in age have not been harvested in well over 100 years. However, because Baxter Woods is less than 100 acres in size MNAP reports that none of the forest communities there qualify a “natural community of statewide significance.” Nonetheless, as an example of old-growth oak-pine-hemlock forest Baxter Woods may be without par anywhere in Maine.

Recommendations

- Management of the forest consistent with the MBW deed restrictions would also be consistent with the MNAP guidelines for natural communities and help protect its significance.

Vernal Pools

Identification and Ecological Significance

Vernal pools are small, fishless water bodies that provide breeding habitat for a unique group of amphibians and invertebrates, including (yellow) spotted and blue-spotted salamander, four-toed salamander, wood frog, and fairy shrimp. During most of the year, adult spotted salamanders and wood frogs are found in the nearby forest; spotted salamanders may be found up to several hundred feet from the pools and wood frogs are found up to a quarter mile or more from pools. Vernal pools are best identified in spring when breeding adults and/or eggs are present. By mid or late summer they are frequently dry. Typically, vernal pool species breed in small isolated pools and ponds, but other areas such as forested wetlands and stream floodplain channels are also often used. See ***Focus Species Forestry*** guidebook for more information. More detailed information may be found in ***Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine*** (Calhoun and deMaynadier 2004).

Current Conditions

Two areas with some vernal pool characteristics were observed in MBW (see Stand Map). Informal observations were recorded during an April, 2016 field visit and again in October 2017.

- **VP1.** This is ephemeral pool formed by a small seep near the Forest Home site. A short stone wall at one end of the pool, its location adjacent to the Forest Home site, and the overall configuration suggest that some evidence that this pool may have been enhanced during the Smith estate period of the property to be part of the estate landscaping. The pool is currently 6-8" deep at spring high water and was dry when observed in October 2017. No spotted salamander or wood frog eggs were observed in April 2016 when eggs were found elsewhere in MBW.



Vernal Pool 1 was probably a landscape feature of the Forest Home Estate and could be enhanced by increasing its depth.

- **VP2.** VP2 is a small excavated pool in Stand 9, but with water over 12" in depth in April 2016. At that time 12 spotted salamander egg masses and 1 wood frog egg mass were observed in the pool. In October 2017 this pool was dry, but the number of egg masses observed suggests that the pool has a sufficiently long hydroperiod in some years to maintain small population of obligate vernal pool amphibians.
- **Pond.** In April 2016 both spotted salamander and wood frog egg masses were observed in the pond.

Recommendations

- VP1 could be enhanced to deepening the pool to a depth of 12"-16" to improve its potential value as vernal pool habitat. A short section of PVC pipe extending 2 ft. below the pool bottom could be installed to serve as a water table monitoring well. Water table depth data from this well could then be used to decide whether or not excavating the pool would be effective.
- VP2. This pool was clearly excavated and has steep sides and a small berm of excavated material around the edges. The pool could be visually enhanced by contouring the edges to create a more natural appearance.

Aquatic Habitats and Riparian Zones

Identification and Ecological Significance

Aquatic habitats at Baxter Woods include the pond near Forest Avenue and the ephemeral stream. Riparian areas are areas that are influenced by, and that influence, aquatic habitats. Species that benefit from aquatic habitats vary greatly with size, depth, vegetation, bottom structure, current, and other factors. Over 60 wildlife species in Maine are dependent on the adjacent riparian habitats for part of their life cycle, and many other species are frequently found in riparian habitats.



Pond. Despite its small size and urban location the pond attracts great blue herons, mallards, black ducks, amphibians, and many other species.

Ephemeral stream. A small, seasonally intermittent stream and tributary are located in the southeast corner of the property. The stream ends in a storm drain near Forest Avenue. Stream surveys were not part of assessment in this plan, but values presumably include habitat for some insects and other invertebrates, and as a source of naturally filtered water that drains into the Back Cove estuary.

Recommendations

- Maintain a border of native vegetation around the pond and landscaping as necessary to direct foot traffic to targeted areas where soil compaction and vegetation disturbance would be minimal.
- Maintain the forest adjacent to the stream in a natural condition. Keep the number of trail crossings to minimum. Where crossings cannot be avoided orient trail perpendicular to the stream. Avoid trails that closely parallel the stream (e.g., within 25 feet).

Wildlife Trees, Dead and Downed Wood, and Retention Patches

Identification and Ecological Significance

Wildlife trees include:

- **Snags:** Dead standing trees.
- **Cavity or den trees:** Live trees with nesting cavities or mammal dens.
- **Recruitment trees:** Large live trees that will be permanently retained (i.e., will never be harvested) and will eventually contribute to the snag, cavity tree, and downed woody material for wildlife and other biodiversity benefits. Typically these are large trees with significant decay or other cull defect, or beech with evidence of bear use

Downed Woody Material: Fallen tree trunks, branches and leaves.

Retention Patches: Areas of live vegetation roughly $\frac{1}{4}$ acre or more that are retained within larger harvest openings (e.g., >5 acres).

Wildlife trees and downed woody material are recognized for their value to vertebrate wildlife (e.g., woodpeckers, marten, wood ducks, and salamanders), insects, and fungi and for their role in the cycling of nutrients and organic matter in the forest. Standing dead wood and woody debris also provide nesting and hibernation habitat for native bee species. All sizes provide value, but large cavity trees (> 16 inches) are required by species such as barred owl and wood duck. The value of downed woody material also increases with size.

Retention patches are used when harvesting (for certain silvicultural or wildlife habitat management objectives) removes most of the overstory. In these cases retained patches of trees and other vegetation serve as a habitat “lifeboat” for species with low mobility (e.g., understory herbs, lichens, mosses and liverworts) whose habitat would be eliminated by even-aged management practices that clear most vegetation when regenerating the forest. Retention patches over one acre in size have the best temperature, humidity, and light conditions for retaining understory plants.



Decaying trees provide feeding and nesting habitat for woodpeckers. Excavated nest cavities in turn provide habitat for other species.

Observations

- Snags, cavity trees, and large and small woody material are moderately abundant in Baxter Woods.

Recommendations

- Allow dead, dying trees, and downed trees and limbs to remain in place unless they represent a threat to trail users.
- Scatter downed limbs that fall on trails within the forest rather than chipping them.

Forest Health

Invasive Plants

Identification and Ecological Significance

The Maine Natural Areas Program defines an invasive plant as “a plant that is not native to a particular ecosystem, whose introduction does or is likely to cause economic or environmental harm or harm to human health.” MANP describes invasive plants as “a direct threat to what we value about Maine's natural and working landscapes [and the] second-greatest threat to global biodiversity after loss of habitat. Invading plants out compete native species by hogging sunlight, nutrients, and space. They change animal habitat by eliminating native foods, altering cover, and destroying nesting opportunities” ([MNAP website, 2017](#)). A list of some of the most problematic invasive species commonly found in Maine forests is included in the Appendices.

Current Conditions

The location of invasive plants is shown on the Invasive and other Exotic Plants map. Norway maple (classified as “probably invasive” by the Maine Natural Areas Program) is the most abundant exotic species. It dominates one stand (Stand 1) and is exhibiting invasive behavior in many areas of the MBW. Other species observed in mixed patches or as scattered clumps include Asiatic bittersweet, bush honeysuckle, common buckthorn, Japanese barberry, Japanese knotweed, Bishop’s weed (also “probably invasive”). Linden is an exotic species that is not classified as invasive but it is becoming well established in the understory and mid-canopy in many places. Lemon balm, another exotic not “invasive,” was observed in a large patch in Stand 11. Lists of invasive plants are included in the Individual Stand Descriptions and Recommendations.



Bishop’s weed (goutweed) is an example of an invasive exotic plant that is preventing the growth of native species in Mayor Baxter Woods

Some invasive plant control has occurred. Larger Norway maples in the vicinity of Hartley street were cut to eliminate seed sources, but where small Norway maples were cut and not treated with chemicals aggressive re-sprouting has occurred.

Recommendations

- The City should develop a plan and implement a plan to control and monitor invasive plants and other aggressive non-native plants throughout the MBW.
- To prevent introduction of other invasive plants, equipment used in the forest should be pressure-washed before being used on site.
- If mulch is needed, only use weed-free mulch, such as straw or wood chips that do not have any invasive plant seeds.

General approaches. Early detection and control is the key to managing invasive species. Small vines and shrubs may be pulled by hand, but treatment with a safe herbicide is the most effective means of controlling larger plants or large areas. Treatment methods are summarized in the Appendices.

Mechanical Control. Cutting is not an effective control measure as invasive plants will re-sprout vigorously. With diligence both barberry and smaller honeysuckle plants may be effectively controlled by hand pulling. During the spring when soils are moist is generally the best time. Pull all plants that are not too large. An “Extratigator” or similar brush puller (e.g. “Weed Wrench”) may be used to pull larger plants. To limit the chance of re-sprouting, care should be taken to ensure that as much root material as possible is removed. Any plants that are too large for pulling should be marked with flagging and GPS for follow-up control with chemicals.

Chemical Control. Where hand pulling is not effective or feasible, herbicides are generally the only effective treatment option. When properly handled and applied the herbicides glyphosate and triclopyr have been shown to have very low risk for organisms other than plants and they have minimal soil movement and break down rapidly. Other chemicals may be more effective in certain situations. Treatment methods are localized (individual plants and/or cut plant stems) and designed to minimize the amount of chemical use and damage to non-target plants. These chemicals and methods are recommended by The Nature Conservancy and other conservation groups for management of natural areas.

Follow-up monitoring and control 2-3 years after the initial treatment is necessary, regardless of whether mechanical or chemical controls are used.

Herbicide use is regulated by the Maine Board of Pesticide Control and all legal requirements must be followed.

Insects and Diseases

Current Conditions

Elongate hemlock scale (*Fiorina externa*) is a serious exotic pest of eastern hemlock. It also can be found on fir, spruce and other conifers. EHS attacks the surface of the hemlock needle and sucks out the fluid. This process causes the needles to turn yellow and drop prematurely ([Maine Forest Service webpage](#))

accessed 2/8/18). EHS was observed on several plots during the field assessment and is the likely cause of hemlock mortality in Stand 5b.

Hemlock wooly adelgid is an invasive aphid-like insect that feeds on hemlocks that has devastated hemlock stands in southern New England and in the Appalachians. HWA has spread north through the Midcoast region of Maine and is causing hemlock decline and mortality throughout this region. In northern New England decline can be slow, and cold winters tend to kill many of the insects. No evidence of hemlock decline caused by HWA – typically a thin, pale-green crown – was observed at MBW during the field reconnaissance, but it has been observed by City Forester Jeff Trarling.

Red pine in Maine is threatened by several pests and diseases, including the exotic red pine scale, and *Siroccocus* shoot blight, which is devastating red pine plantations in Maine. There is no evidence that the MBW red pine plantation (Stand 1) is affected yet, but this stand as well as the mature red pine scattered throughout Baxter Woods are at risk.

Beech-bark disease, which results from the combined action of exotic insect and an exotic fungus, has devastated American beech stands throughout its range. Beech bark disease was observed at MBW, but the trees are very healthy compared with most areas in Maine. There is no known control for beech bark disease. Dead and dying trees can be removed, but because beech regenerates through root, suckers and mature trees are often connected by root systems, it is impossible to eliminate or slow the disease by cutting.

Browntail moth, winter moth, and gypsy moth are exotic insects are serious threats to oak forests, and will also affect some other tree species. None have been observed at MBW to date, but browntail moth and winter moth are common in the Casco Bay region. Personal observations are that the oldest trees are most at risk during winter moth outbreak. Browntail moth seems to result in less tree mortality, but the toxic hairs shed by the developing caterpillars cause significant rashes on most people.

Recommendations

Hemlock Wooly Adelgid and Elongate Hemlock Scale

- Develop a comprehensive plan to monitor and control hemlock wooly adelgid and elongate hemlock scale.
- Consult with the Maine Forest Service and other experts as needed. Management references are included on the [Maine Forest Service HWA web page](#), and Forest Synthesis can provide contacts at the Nature Conservancy, which has an active program and recommendations to control HWA in key ecological areas.
- Chemical pesticides are generally the only consistent method to control HWA and EHS. However, the Maine Forest Service and US Forest Service are experimenting with biological controls, and the City should ask MFS if they would use Baxter Woods as an experimental site.
- Even if biological controls are used, the city should map and protect individual, old hemlocks with chemical methods. Ground injections of systemic pesticides (e.g., imidacloprid) can provide long lasting control of individual trees (up to 10 years), and studies have shown there is no evidence of chemical movement beyond the treated tree.

Red Pine Pests and Diseases

- To reduce the risk of major loss of red pine from red pine scale, *Sirococcus*, and other diseases, monitor for these threats and manage the red pine plantation to allow a mixed stand of red pine and other native trees and shrubs to develop over time. See Stand 1 recommendations for details.

Browntail Moth, Winter moth, and Gypsy Moth

- Develop a contingency control plan for browntail moth, winter moth, and gypsy moth and monitor the forest on a regular basis for the presence of these exotic insect pests.

Planning for Climate Change

Researchers have estimated that Maine’s average temperatures will increase at least by 3.5° F by 2100 if climate-warming emissions are significantly reduced and by as much as 12.5° F if emissions are not reduced. By 2100, the optimum climate for spruce and fir is predicted to shift to north of the Canadian border, while the optimum climate for northern hardwoods such as sugar maple and yellow birch is predicted to retreat to the western mountains and northwestern highlands of Maine. The northern limit of optimum climate for oak, which is now best adapted to southwestern Maine, is predicted to shift north to the Canadian border. Trees that are outside of their optimum climate are likely to become stressed, with potential for increased rates of health decline and mortality due to insects and diseases. Disturbances, including harvests and other management actions, can be used to facilitate the response of vegetation types to climate change.

Examples of species that are tolerant of warmer temperatures include white pine, red oak, and red maple. The general recommendations below have been developed by the author for consideration when developing plans for forest management.

Recommendations

- Landowners and managers can help mitigate climate change by sequestering carbon in soils, the forest floor, and in the canopy. Forest soil carbon loss can be minimized by avoiding clearcutting and other practices that heat the forest floor and increase decay and oxidization of organic matter. Managing for older and larger trees will store more carbon on the stump. Some studies have shown that carbon is also sequestered in long-lived forest products after trees are harvested.
- Consider planting species that are currently at the northern limit of their range and that can tolerate warmer temperatures.
- Increase culvert sizes over those included in BMP guides and otherwise modify water management and stream crossing practices to accommodate increases in storm severity



Cool-climate species such as sugar maple and yellow birch (shown here) as well as red spruce and other species may decline as the climate warms. Red oak, white pine, and red maple are well adapted to a warming climate.

Other Management Considerations

Historical, Cultural, and Archaeological Sites

Mayor Baxter Woods is well known as the site of the “Forest Home” estate of Francis Ormond Smith. Evidence of the estate remains in the form of cut granite blocks and landscape alteration near the small field in the northwestern part of property (Stand Map, areas 2B and F3). Archaeological studies in 2014 by Norm Buttrick and students from Catherine McCauley High School identified evidence of the estate.

Recommendations

- Compile information from the Buttrick study and other sources to create a more complete and accurate history and maps of land use at MBW. These could be used for educational purposes and as a record for long-term management.
- Consult with Maine Office of Historic Preservation about possible location of other historical and archeological sites.

Societal Considerations

Public forest management should include opportunities for members of the public to provide comments on draft plans before they are finalized.

Boundary Lines

Clearly marked boundaries are necessary to prevent timber trespass and other damage to property, including both protection from abutters and to ensure that you do not encroach on the lands of others. Boundary lines are delineated by roads, stone walls, and shorelines.

Current Conditions

- Boundaries formed by Forest Avenue, Hartley Street, and Stevens Avenue are clear.
- A chain link fence marks the north boundary.
- The boundary north of residences on Hartley Street (vicinity of Stand Map, area 11) has a few survey pins, but is not marked between the widespread pins. Most residential properties on Hartley Street have encroached onto City property (Stand Map, areas 11 and F4) Examples of encroachment include fencing, paved driveways, lawns, and gardens and brush dumping.
- Cedar post and rail fencing marks most of the boundary behind residences on Steven’s Avenue. However, sheds and equipment from two abutting properties at the south edge Stand 2a encroach several feet onto City property where there is no fence.

Recommendations

- Where MBW abuts residential properties on Hartley Street and Stevens avenue the City should clearly mark the boundary with fencing or other means (e.g., multiple posts and signs) and work with abutters to restore degraded city property to a natural condition. City Forester Jeff Tarling that surveyors will be working on this line in 2018.
- Signs should be placed a various points along other boundaries and access points



Example of unmarked property line and encroachment behind residences on Hartley Street.

Recreational Use

Current Conditions

- Walking, bike riding, and dog walking are common recreational activities in MBW. See maps for trail locations.

Recommendations

- As noted elsewhere in this report, recreational uses and in particular unleashed dogs are likely having and adverse impact on ground-nesting and ground-feeding birds. Because the Baxter deed requires that the City maintain Baxter woods for recreational use and as a sanctuary for wild birds, the city should require that dogs be leashed.
- The city could consider closing some minor trails to create wider spaces between trails and thus minimize disturbance of wildlife.

Forest Fire Protection

The property does not present any unusual vulnerability to fire compared with other wooded properties in the region. Forest fire risk is generally low due to Maine’s climate. In the unlikely event that fire did occur, the current trail network provides good access to the interior of the forest for fighting fires.

Monitoring

Periodic monitoring is important to identify trend and issues that may develop and to help provide information for future management decisions. Many monitoring activities could be conducted by qualified volunteers. Recommended monitoring activities are included below.

Vernal Pools. Annually monitor depth, hydroperiod, and use by vernal pool species and other wildlife in April-May. See *The Maine Municipal Guide to Mapping and Conserving Vernal Pools* (Morgan and Calhoun 2012).

Breeding birds. Annually coordinate a post-migration breeding bird survey with Maine Audubon volunteers (June). Divide the forest into four to six monitoring blocks and identify singing males in each block. Compile data by species and the canopy layer where they are known to nest (see *Forestry for Maine Birds*). Ideally compare results with Evergreen Woods. Bird data from the spring migration period (May) would also be of interest.

Insects and Diseases. Monitor hemlock wooly adelgid, elongate hemlocks scale and other insects (see *Insect and Disease* section of this report). Contact the MFS District Forester or the MFS Division of Forest Health Monitoring (207-287-2431) if any concerns arise.

Invasive Plants. Monitor results if invasive plant controls and periodically check for new occurrences. Take appropriate action if any are found. See *Invasive Plants* section and Appendices for more information.

Condition of roads and trails. Check roads and trails for blocked ditches, culverts, and erosion problems.

Boundary lines. Periodically inspect boundary lines to be sure evidence is clearly visible and to check for unwanted encroachment from abutting properties.

Recreation use. Use trail cameras or other monitoring methods for fixed periods of time to quantify and describe recreation use and evaluate the potential impact of unleashed dogs on wildlife.

References and Resources

Literature Cited

Bryan, R.R. 2007. **Focus Species Forestry: A Guide to Integrating Timber and Biodiversity Management in Maine.** Maine Audubon, Falmouth, ME. Download: <http://www.forestsynthesis.com/resources.html>.

Maine Audubon. 2017. **Forestry for Maine Birds.** Maine Audubon, Falmouth, ME

Maine Department of Conservation. **Best Management Practices for Forestry: Protecting Maine's Water Quality.** Maine Forest Service, Augusta, ME. 1-800-367-0223.

Morgan, D.E., and A.J.K. Calhoun. 2012. **The Maine Municipal Guide to Mapping and Conserving Vernal Pools.** University of Maine, Sustainability Solutions Initiative, Orono, ME.

Mayor Baxter Woods Resources

2014 Archaeological Survey. <https://dcna.me/forest-home-of-francis-oj-smith/> (accessed 1/2/2018)

Appendices

Mayor Baxter Woods Deed Restrictions

As quoted in the City's **Welcome to Mayor Baxter Woods** brochure, restrictions in the 1946 deed from Governor Percival P. Baxter to the City include:

"...the above described premises with all the privileges and appurtenances thereto to said City of Portland as trustee as foresaid and its successors in trust and the same shall not be conveyed or encumbered by said City but shall be held forever for the benefit of the people of said Portland subject to the following terms, restriction, reservations and conditions:

- 1. shall forever be retained and used by said City in trust for the benefit of the people of Portland as a Municipal Forest and Park for public recreational and educational purposes the same forever to be known as "MAYOR BAXTER WOODS";*
- 2. shall forever be kept in its natural wild state and as a sanctuary for wild birds, with no streets for public conveyances and no cement walks therein and with only paths and trails for pedestrians, and any trees that shall fall or that may become a menace to life may be removed, but no other trees therein shall be taken down;*
- 3. shall forever be maintained for the sole use of pedestrians; and horses, automobiles and all motor vehicles, except those of the City used solely in caring for said woods, shall forever be excluded therefrom;*
- 4. that the heavy ornamental gates now in possession of said City shall be erected by said City either at the Forest Avenue or Stevens Avenue entrance within one year of the date of this deed;*
- 5. that said City shall erect within one (1) year after the date of this deed and shall forever maintain on the land hereby conveyed a suitable bronze marker the said marker to recite the conditions of this gift, the same to be attached to a granite boulder located on said land and provided by said City."*

Assessment Methods

Aerial photography, published maps, and field reconnaissance were used to map the extent of wetlands and the location of streams. Field map data were collected on a hand-held Global Positioning System (GPS) receiver. Base map information was prepared on a Geographic Information System (GIS) using data from the Maine Office of GIS and the field data.

The on-site visit occurred on March 26, 2016. Observations recorded in each forest stand included species composition, canopy closure, understory density, average tree size classes and quality, tree health, forest regeneration, soils and site conditions. There was no systematic timber inventory. Field data collected provides a basis for management recommendations and satisfies the requirements of the Tree Growth Tax Law.

Each stand has a number of the Forest Stand and Cover Type Map. To avoid repetitive text, where appropriate stands that are similar in character have been grouped in the descriptive tables below.

Individual Stand Descriptions and Recommendations

The following descriptions are based on an analysis of aerial imagery and the field assessment undertaken during October-December 2017. After discussions with the City it was agreed that quantitative, statistically valid forest inventory was not needed to gather the information needed to describe baseline conditions and develop recommendations designed to meet the City's objectives.

Notes on the stand descriptions and recommendations:

- **Wildlife Habitat Values.** Wildlife values are primarily based on the forest type and structure. The small size of the forest and setting in a developed landscape will limit habitat potential for many species, as will the high density of trails and number of unleashed dogs. These issues are discussed elsewhere in the report and are generally not addressed in the individual stand tables below.
- **Management recommendations.** Management recommendations in the stand tables below are generally limited to vegetation management options. Other recommendations, such as those for trails and strategies for multi-stand issues such as control of exotic insects, are addressed elsewhere in the report.

Stand 1		Map Unit	Acres
		1	0.54
CURRENT CONDITIONS			
Cover Type	Red (Norway) Pine	Overall Structure Class & % Cover	3B
Principle canopy species:	Red Pine	Overstory Class & % Cover	3a/B
		Midstory Class and % Cover	0
		Understory Class & % Cover	0
Stand description, age and history:	This stand was planted in 1949 and has a single canopy layer 6-10" in DBH (diameter at breast height, or 4.5 ft.) and 30-50 ft. in height. The southern and western sides were thinned in 2004 and have a layer of lowbush blueberry, asters, and grasses as well as seedlings and sprouts of red oak and black cherry. Seedlings near the edges have been mown periodically. The smooth soil surface topography in this and nearby stands suggest that the western third Baxter Woods was a field at one point in time.		
Wildlife Habitat Values	Wildlife habitat is essentially limited to the overstory canopy layer provides wildlife cover and feed (seed from cone crops) for species that tolerate high levels of human activity.		
Stand stocking:	The area that was thinned is well stocked but is nearing the time when another thinning would promote continued growth. The unthinned area is overstocked with trees of small crowns, which severely limits growth potential. Thinning the entire stand would promote the most vigorous trees as well as allowing native species to develop in the under understory, thereby improving		
Soils, Slopes, Site Quality, and Growth Rate	Soils are nearly level and well drained with good site quality. Growth rates estimated to be average.		
Forest Health	No forest health issues were noted, but the exotic red pine scale insect and <i>Siroccocus</i> shoot blight are devastating red pine plantations in Maine and this stand is at risk.		
Invasive and Exotic Plants	Bittersweet and Norway maple, <5% cover		
Cultural Features	This is a planted stand. A trail passes through the east side of the stand and along the west edge.		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species pine-oak forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> • Thin the stand to approximately 60% canopy closure to promote regeneration of native trees, which will be aided by jays, squirrels, and other wildlife moving seeds from nearby stands. This will improve wildlife habitat and promote transition to a more natural species mix while reducing impacts should red pine scale or <i>Siroccocus</i> become established. 		

	<ul style="list-style-type: none"> Control invasive plants. In approximately 10 year the stand should be thinned again to less than 50% canopy cover of red pine. Stand edges should not be mowed.
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Stand 2a		Map Unit	Acres
		2a	2.85
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Oak		5B
Overstory	Red oak (80%), white oak		5B
Midstory	Red oak, black cherry, hemlock, red maple, linden		2-3D
Understory:	Black cherry, red maple.		70%
Stand description, age and history:	Overstory of mature red oak 16-30" DBH and 60-80' in height overtops a low-density midstory of hardwood saplings and small poles with a minor hemlock component. The smooth soil surface topography in this and nearby stands suggests that the western third Baxter Woods was a field at one point in time.		
Wildlife Habitat Values	The overstory and midstory provide good nesting and bird foraging habitat and acorns are a valuable food for many species, but species characteristic of larger forest blocks are unlikely to nest here. Large snag and/or canopy trees and downed logs were observed.		
Stand stocking:	Well stocked with large trees.		
Soils, Slopes, Site Quality, and Growth Rate	Soils are gently sloping and well drained with good site quality. Growth rates estimated to be average to above average.		
Forest Health	No issues were noted		
Invasive and Exotic Plants	Norway maple, Asiatic bittersweet common buckthorn, and bush honeysuckle, 20-50% cover in patches, found throughout most of the stand.		
Cultural Features	A large rectangular pit reminiscent of a cellar hole but with no evidence of a foundation is located north of the main carriage trail. Sheds and equipment from tow abutting properties at the south edge of this stand encroach several feet onto City property where there is no fence.		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species deciduous forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> Control invasive plants Refer to general recommendations for trails Research history of "cellar hole" (see cultural features) No other active management recommended at this time. 		

Stand 2b		Map Unit	Acres
		2b	0.92
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Oak –White Pine		5B
Overstory	Red oak & white oak (80%), plus white pine and red pine		4-5B
Midstory	Red oak, black cherry, red maple		2C-
Understory:	Black cherry, alternate-leaved viburnum.		1-2C
Stand description, age and history:	Mature hardwoods with a mixed conifer component. The overstory ranges from 12-24" DBH and 50-70' in height. Ground cover species noted include lowbush blueberry, black cherry seedlings, and asters. The smooth soil surface topography in this and nearby stands suggests that the western third		

	Baxter Woods was a field at one point in time.
Wildlife Habitat Values	In addition to species favoring mature hardwoods, pine warblers may nest in this stand, but species characteristic of larger forest blocks are unlikely to nest here.
Stand stocking:	Well stocked with mature trees
Soils, Slopes, Site Quality, and Growth Rate	Soils are gently sloping and well drained with good site quality. Growth rates estimated to be average to above average.
Forest Health	No issues were noted
Invasive and Exotic Plants	Norway maple, Asiatic bittersweet common buckthorn, and bush honeysuckle, 20-50% cover in patches, found throughout most of the stand.
Cultural Features	A level feature reminiscent of a landscape patio bordered by large cut stones is located in the southeast corner of this stand north of the carriage trail.
Management Objectives and Recommendations	
Desired Future Condition	Older, mixed species pine-oak forest with multiple canopy layers
Management Recommendations	<ul style="list-style-type: none"> • Control invasive plants • Refer to general recommendations for trails • Research and decide on management of the “patio” area described above • No other active management recommended at this time.

Stand 3		Map Unit	Acres
		3	3.12
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	White Oak-Red Oak-White Pine		4B
Overstory	White oak, red oak, white pine, plus lesser amounts of hemlock and white ash		3-5B
Midstory	Hemlock, red maple		3C
Understory:	Hemlock, red maple		<5%
Stand description, age and history:	Mature hardwoods with a mixed conifer component. The largest oaks range from 20-40” DBH, with other species in the 12-20” diameter range. Ground cover species noted include lowbush blueberry, black cherry seedlings, and asters. The smooth soil surface topography in this and nearby stands suggests that the western third Baxter Woods was a field at one point in time.		
Wildlife Habitat Values	In addition to species favoring mature hardwoods, pine warblers may nest in this stand, but species characteristic of larger forest blocks are unlikely to nest here.		
Stand stocking:	Well stocked with mature trees.		
Soils, Slopes, Site Quality, and Growth	Soils are gently sloping and well drained with good site quality. Growth rates estimated to be average to above average.		
Forest Health	No issues noted. Hemlock wooly adelgid may be present but it was not observed in the understory.		
Invasive and Exotic Plants	Norway maple, Asiatic bittersweet common buckthorn, and bush honeysuckle, 20-50% cover in patches, found throughout most of the stand.		
Cultural Features	None noted except trails		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> • Refer to general recommendations for trails • No other active management recommended at this time 		

Stand 4		Map Unit	Acres
		4	5.47
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Oak		4-5A
Overstory	Red oak, plus minor component of beech, white oak, white ash, sugar maple, yellow birch and hemlock		5A
Midstory	Hemlock, beech, red maple, red oak		2C
Understory:	Beech, witch hazel, black cherry, balsam fir		5-70%
Stand description, age and history:	This is primarily a hardwood stand with hemlock in small patches. Structure is multi-aged but a mature canopy is dominant, ranging from 12-30" DBH and 60-80' in height.		
Wildlife Habitat Values	This stand provides habitat values of mature deciduous mixed forest, but species characteristic of larger forest blocks are unlikely to nest here. Scattered snags and cavity trees 12-18" observed.		
Stand stocking:	This stand is well stocked with mature trees.		
Soils, Slopes, Site Quality, and Growth	Soils are gently sloping and well drained with good site quality. Growth rates estimated to be average to above average.		
Forest Health	No issues were noted		
Invasive and Exotic Plants	Norway maple, Asiatic bittersweet common buckthorn, and bush honeysuckle, 20-50% cover in patches, found throughout most of the stand.		
Cultural Features	Carriage trail and footpaths		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> Control invasive plants Refer to general recommendations for trails No other active management recommended at this time. 		

Stand 5a		Map Unit	Acres
		5a	12.04
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Oak-White Pine-Hemlock		4-5A
Overstory	White oak, red oak, white pine; associated include hemlock, red pine, red maple, white ash, beech, and yellow birch		5B
Midstory	Hemlock, plus lesser amounts of red maple, white ash and yellow birch		2-3B
Understory:	Hemlock		0-30% (average <10%)
Stand description, age and history:	This is a distinctly two-aged stand with a mature hardwood-dominated canopy 16-30" DBH and 60-80' in height over an intermediate conifer layer dominated by hemlock. The presence of scattered large, old (probably over 150 years) hemlock in the overstory suggests that this area may never have been completely cleared. In contrast to the stands nearer to Stevens Avenue, the hummocky soil surface topography indicates that this area was never plowed.		
Wildlife Habitat Values	This stand provides habitat values of mature mixed hardwood-conifer forest, but has a minimal understory and ground cover layers favored by some species, and species characteristic of larger		

	forest blocks are unlikely to nest here.
Stand stocking:	Well stocked with mature trees.
Soils, Slopes, Site Quality, and Growth	Soils are gently sloping, moderately well drained on the west to somewhat-poorly drained in lower-lying drainages and seeps downslope to the east. Growth rates estimated to be average.
Forest Health	Hemlock scale was observed on two plots; hemlock wooly adelgid (HWA) may be present in small amounts but was not observed. Due to the large amount of hemlock in this stand complete control of HWA may not be feasible and cultural practices to promote species diversity should be considered. No other issues were noted.
Invasive and Exotic Plants	A patch dominated by bittersweet is located near the west end of the stand adjacent. Linden, an exotic not technically classified as “invasive” is becoming established in the understory (see map).
Cultural Features	A shallow seasonal pool that appears to have been a landscape feature of the Forest Home estate is located near the western end of this stand (see map VP1). Carriage trails and footpaths cross the stand in a generally east-west direction.
Management Objectives and Recommendations	
Desired Future Condition	Older, mixed species forest with multiple canopy layers
Management Recommendations	<ul style="list-style-type: none"> • Control invasive plants • Consider excavating the seasonal pool (VP1) to a high-water depth of 18-28” to enhance habitat values for amphibians • Closing the two footpaths within the stand interior would reduce disturbance to wildlife. • Refer to general recommendations for trails • Removing some of the midstory hemlock in other parts of the stand would proactively reduce risk of hemlock loss while enhancing wildlife habitat by promoting understory and ground cover plant layers. However, this does not appear to be allowable under the deed restrictions.

Stand 5b		Map Unit	Acres
		5b	0.49
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Hemlock		5B
Overstory	Hemlock, plus white pine, red oak, and yellow birch		5C
Midstory	Hemlock, red oak		2-3C
Understory:	Hemlock beech		20%
Stand description, age and history:	This is a legacy patch of very old (probably over 150 years) hemlock and other species. There is no evidence of cutting.		
Wildlife Habitat Values	This stand is an inclusion within the larger Stand 5a. Refer to that stand description for details		
Stand stocking:	Moderate density due to some loss of overstory hemlock.		
Soils, Slopes, Site Quality, and Growth Rate	Soils are gently sloping, moderately well drained on the west to somewhat-poorly drained in lower-lying drainages and seeps downslope to the east. Growth rates estimated to be average.		
Forest Health	Several large hemlocks have died within the past 10 years, possible from hemlock scale.		
Invasive and Exotic Plants	None noted		
Cultural Features	Footpath		
Management Objectives and Recommendations			
Desired Future	Older, mixed species forest with multiple canopy layers		

Condition	
Management Recommendations	<ul style="list-style-type: none"> Control elongate hemlock scale and hemlock woolly adelgid (see <i>Insect and Disease</i> section) Refer to general recommendations for trails

Stand 6		Map Unit	Acres
		6	0.84
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Oak – White Pine		4-5A
Overstory	Red oak, white pine, plus beech and red pine		4-5A
Midstory	Hemlock, beech; associates include red maple and yellow birch		2-3C
Understory:	Hemlock, beech		<30%
Stand description, age and history:	Mature hardwood-conifer mix with a dense, mature overstory 12-24" DBH and 60-80' in height over a moderate density understory and midstory. This stand is very similar to Stand 4 and has a lower hemlock component than Stand 5. An old fire scar was observed on a white pine stump.		
Wildlife Habitat Values	Typical of a mature oak-pine forest, but species characteristic of larger forest blocks are unlikely to live here.		
Stand stocking:	Well stocked with mature trees.		
Soils, Slopes, Site Quality, and Growth	Soils are gently sloping and moderately well drained with apparently average growth rates.		
Forest Health	Hemlock scale and beech-bark disease (<i>Nectria</i> canker) observed		
Invasive and Exotic Plants	None observed		
Cultural Features	Footpath and carriage trail		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species oak-pine forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> Refer to general recommendations for trails No other management activities recommended at this time 		

Stand 7		Map Unit	Acres
		7	0.62
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Maple		3-4A
Overstory	Red maple, plus minor component of red oak and white ash		3-4A
Midstory	Red oak, hemlock, red maple		2D
Understory:	Winterberry, arrow-wood viburnum, balsam fir, hemlock, yellow birch, white pine		+/- 50%
Stand description, age and history:	This is younger, even-aged stand that developed on what was likely an old field. The overstory is 8-12" DBH and 50-70' in height. The smooth soil surface topography in this area was likely a field at one point in time.		
Wildlife Habitat Values	The dense understory provides cover not generally found elsewhere in Baxter Woods.		
Stand stocking:	Well stocked with intermediate-sized trees.		
Soils, Slopes, Site Quality, and Growth	Mostly level, somewhat poorly drained with poorly drained patches. Growth rates estimated to be average to below average where wet.		

Forest Health	No issues were noted
Invasive and Exotic Plants	Japanese knotweed, barberry, burning bush
Cultural Features	None observed
Management Objectives and Recommendations	
Desired Future Condition	Older, mixed species pine-oak forest with multiple canopy layers
Management Recommendations	<ul style="list-style-type: none"> Control invasive plants Allow this stand to develop - no other management activities recommended at this time.

Stand 8		Map Unit	Acres
		8	0.59
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	White Pine – Red Oak – Red Maple	4-5A	
Overstory	White pine (60%), plus red oak, white oak, and red pine	4-5A	
Midstory	Red oak, white oak, yellow birch , beech, white ash	2C	
Understory:	Red oak, balsam fir, maple-leaved viburnum, hazelnut, huckleberry, lowbush blueberry	60-70%	
Stand description, age and history:	The overstory is 12-24” DBH and 60-80’ in height. This essentially an even-aged stand but with a developing understory. The smooth soil surface topography in this was likely a field at one point in time.		
Wildlife Habitat Values	This stand buffers one side of the pond and has better understory habitat that is more robust than in most other parts of the forest. General habitat values are characteristic of older forests but species characteristic of larger forest blocks are unlikely to nest here. Large (>18”) and mid-sized snags and/or cavity trees were observed here.		
Stand stocking:	Well stocked with mature trees.		
Soils, Slopes, Site Quality, and Growth Rate	Soils are gently sloping and appear to be moderately well drained. Growth rates are estimated to be average.		
Forest Health	No issues were noted.		
Invasive and Exotic Plants	A single Japanese barberry plant was observed.		
Cultural Features	Two short “wildcat” trails (unauthorized footpaths) lead from the pond area to Forest Avenue		
Management Objectives and Recommendations			
Desired Future Condition	Older, mixed species pine-oak forest with multiple canopy layers		
Management Recommendations	<ul style="list-style-type: none"> Control invasive plants Consider blocking the wildcat trails No other management activities recommended at this time. 		

Stand 9		Map Unit	Acres
		9	1.8
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Red Maple-Red Oak	4-5B	
Overstory	Red maple, red oak, white ash, beech	4-5B	

Midstory	White ash, yellow birch, hemlock, red maple	2C
Understory:	Balsam fir, beech, hemlock, yellow birch, winterberry	+/- 40%
Stand description, age and history:	This is maturing hardwood stand in a low-lying area with stream channels. The overstory is 10-18" DBH and 60-80' in height over a low-density midstory with trees 2-4" DBH.	
Wildlife Habitat Values	A moderately dense understory in the north half of the stand provides good wildlife cover. Several snags and downed trees were observed. A small excavate pool (VP2) was observed in this stand. Twelve spotted salamander egg masses and one wood frog egg mass were observed here in April 2016.	
Stand stocking:	Well stocked with mixed hardwoods	
Soils, Slopes, Site Quality, and Growth	Soils are nearly level with steeper slopes immediately adjacent to the lower section of the stream. Soils vary from moderately well drained to somewhat poorly drained in lower lying areas. Growth appears to be average for the site.	
Forest Health	No issues were noted.	
Invasive and Exotic Plants	One Japanese barberry was observed near the carriage trail.	
Cultural Features	Footpaths and storm drain	
Management Objectives and Recommendations		
Desired Future Condition	Older, mixed species forest with multiple canopy layers	
Management Recommendations	<ul style="list-style-type: none"> Control invasive plants No other management activities recommended at this time. 	

Stand 10		Map Unit	Acres
		10	0.3
CURRENT CONDITIONS			Structure Class and % Cover
Cover Type	Norway Maple		3-4A
Overstory	Norway maple (75%), white ash (25%)		3-4A
Midstory	Red oak, hemlock, red maple		2D
Understory:	Winterberry, balsam fir, hemlock, yellow birch, arrow-wood viburnum		+/- 50%
Stand description, age and history:	This intermediate-aged stand has developed on a site that was a field at one point in time. The dominant Norway maple overstory 1-16" DBH and 60-80' in height developed from seed sources in nearby residential areas.		
Wildlife Habitat Values	A moderately dense provides good wildlife cover in parts of the stand, but other areas are very open. There snags or cavity trees and little downed wood.		
Stand stocking:	Well stocked		
Soils, Slopes, Site Quality, and Growth	Soils are moderately well drained to somewhat poorly drained and slope toward the stream and storm drain near Forest Avenue. Overall site quality and growth rates are good.		
Forest Health	No insect or disease issues were noted.		
Invasive and Exotic Plants	Norway maple dominates the stand. One burning bush plant was also observed.		
Cultural Features	None		
Management Objectives and Recommendations			
Desired Future Condition	Restored forest dominated by native species		

Management Recommendations	<ul style="list-style-type: none"> Remove all Norway maple and plant native species in conjunction with drainage improvements near Forest Avenue
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Area 11. Encroachment Zone 0.22 acres

Description

This narrow strip along the property boundary north of Hartley Street has been encroached upon by the back yards of residences in that area. Small lawns, gardens, and furniture are found on the Baxter Woods property in this area. A slackline has been attached two trees on city property in the woods behind one of the homes. Brush dumping is also evident. Invasive plants include bush honeysuckle, Japanese barberry, Bishop’s weed, and Lemon balm.

Recommendations.

- Clearly establish the property line with a fence or other permanent markers with signage.
- Restore the area to more natural conditions by removing all landscaping features, controlling invasive plants, and planting native trees and shrubs.

Area F1 Stevens Avenue Entrance - 1.06 acres

Description

This area is being managed like a typical city park with scattered trees and mown grass. Overstory trees 10-18” DBH and 60-60 ft. in height cover approximately 15% of the area; species included linden, Norway spruce, sugar maple, and white pine . A patch of recently planted sugar maple 2-3” DBH and 10-20 ft. in height accounts another 15%. Shrubs and understory trees are absent. Wildlife use would be primarily limited canopy species tolerant of edges and human activity. This area provides a transition from the urban environment to the natural forest that characterizes most of Baxter Woods.

Recommendations

- Plant patches of native shrubs with wildlife food and cover value away from the areas of greatest human activity.
- After the City has adopted an action plan for the forest the kiosk could be updated with additional information on the unique ecological values of Baxter Woods and goals for management.

Area F2 Forest Avenue Entrance - 0.41 acres

Description

This area is being managed like a typical city park with scattered planted trees (larch, paper birch, tupelo) and a large white pine and red maple. The entire area between and under the trees is mowed. Wildlife use would be primarily limited canopy species tolerant open-scattered trees and human activity. This area provides a transition from the urban environment to the natural forest that characterizes most of Baxter Woods.

Recommendations

- Plant a border of native shrubs with wildlife food and cover value along the north edge of the mown area and along the pond edge, leaving one or two openings for vistas and pond access.

Area F3 North Meadow 0.72 acres

Description

This area has a diversity of open/edge habitat, including mown grass, old field edges with grasses, goldenrods, raspberries, staghorn sumac, and apple that is unique in Baxter Woods. Invasive plants include common buckthorn along the west edge and bittersweet on the east.

Recommendations

- Control invasive plants.
- Develop a site planting and mowing plan to include:
 - a) Increasing the area in old field habitat by allowing encroachment into the frequently mown area, or purposefully planting patches to native wildflowers that will benefit butterflies and other insect pollinators.
 - b) Planting patches of natives shrubs that provide wildlife food and cover.
 - c) Maintaining the habitat type by mowing old field areas on a 3-5-year cycle so that both old field and shrub patches will always be present, and cut trees that are encroaching on this area if allowed by deed.

F4 Lawn and Shrub - 0.15 acres

Description

Residences near the West end of Hartley Street are encroaching onto City property. The MBW south boundary is unmarked and encroachment appears to extends 20 ft. to 50 ft. past the property line, including includes mown lawn, raised-bed garden, and leaf dumping. The remaining area includes a mix of goldenrods, asters, raspberries and planted white pine and white spruce saplings. Invasive plants include Norway maple and Japanese knotweed.

Recommendations

- Control invasive plants.
- Fence or otherwise clearly mark the entire boundary line and work with abutters to maintain the area in a natural condition. Maintaining a mix of shrubs and old-field herbaceous plants would provide habitat conditions that are under-represented on the MBW.

Maine Audubon Priority Forest Birds

Species, Region ¹ and Habitat Age Class	Preferred Stand Condition	Habitat Preference 1: Preferred; 2: Utilized; 0: Not used			
		Oak Pine	Northern Hardwood	Northern Mixedwoods	Northern Softwoods
Young Forest					
American Woodcock	Young forest and shrub patches with clearings for singing grounds and roosting	2	2	2	0
Chestnut-sided Warbler	Young forest patches typically 5-15 years old	0	1	2	0
Mourning Warbler (N/C)	Young forest with dense understory 2-10 years after harvest	2	1	2	2
Magnolia Warbler	Young of multi-aged forest with dense young conifers	0	0	1	1
Intermediate & Older Forests					
Black-throated Blue Warbler	Intermediate and older forests with dense understory and saplings, large forest blocks	2	1	1	0
Yellow-bellied Sapsucker	Intermediate and older forests with snags or decaying trees and shade-intolerant tree species	2	1	2	0
Eastern Wood-Pewee	Intermediate or older forest with gaps	2	2	2	0
Black-throated Green Warbler	Intermediate to older forest with hemlock or other conifers, large forest blocks	0	0	2	1
Older Forests					
Bay-breasted Warbler	Older – multi story	0	0	2	1
Blackburnian Warbler	Older conifer and mixed interior forest	2	0	1	1
Northern Parula	Older conifer or mixed moist forests, large patches	0	2	2	1
Scarlet Tanager	Older forest with oak, large forest blocks	1	1	2	
Ovenbird	Older forest, large forest blocks	1	1	1	2
Wood Thrush	Older forest, larger forest blocks	1	1	2	
Young to Older Forests					
Veery	Riparian forest and other moist forests with dense understory	2	1	2	2
Black-backed Woodpecker (N)	Variable aged forests with abundant dead/dying conifers	0	0	0	1
Boreal Chickadee	Variable aged forests with cavity or decaying trees	0	0	0	1
Canada Warbler	Variable aged, moist forests with dense understory; riparian areas, swamps	0	2	1	2
Northern Flicker	Variable forest ages, snags or decay trees >12" preferred for nesting	1	1	2	2
Olive-sided Flycatcher	Variable, peatlands, riparian areas, young forest, and gaps with snags	0	0	0	1

¹ Region: N – North, C – Central, S – South. No letter indicates statewide occurrence

Source: **Forestry for Maine Birds: A Forester's Guide**. Maine Audubon, Falmouth, ME. Publication pending 2016

Maine Audubon Priority Species known to breed at HRF or nearby:

Source: noted by J. Witham 2016

Breeding Birds

American Woodcock – breed here on a couple of occasions

Chestnut-sided Warbler – was one male around for a couple of years post-harvest, gaps just not big enough for them

Black-throated Blue Warbler – present in most years, most prevalent when red maple stump sprouts were at their peak

Eastern Wood-Pewee – increased following harvest, numbers down now

Black-throated Green Warbler – most common breeder with Ovenbird

Blackburnian Warbler – third most common

Northern Parula – one or two males every year

Scarlet Tanager – consistent breeder in low numbers

Ovenbird - most common breeder with BTG

Veery – numbers have dwindled to 0-1

Canada Warbler – one male for many years in red maple swamp

Northern Flicker – always around, few observations every year, never found a nest

Migration only

Magnolia Warbler

Yellow-bellied Sapsucker

Olive-sided Flycatcher

Mourning Warbler

Other species never observed at HRF

Harvest Guidelines for Retaining Wildlife Trees and Woody Biomass

General Guidelines for all Managed Stands

Dead Snags	<ul style="list-style-type: none"> All dead snags should be considered for retention. Under conditions where hand crews are operating, snags that represent a hazard should be felled at the logging contractor's discretion as needed to comply with safety guidelines. Felled snags should be left in place.
Live Cavity Trees and Recruitment Trees	<ul style="list-style-type: none"> The general guideline is: <ul style="list-style-type: none"> Four trees per acre >12" dbh, including one >18" dbh. Select cavity trees first, if present, and then use recruitment trees to meet the guideline as needed. Retain a mix of species characteristic of the stand. All live cavity trees with evidence of advanced decay and signs of use by wildlife should be considered for retention. However, cavity trees (<12" dbh) may be removed from the stand for silvicultural purposes unless there are not enough larger trees to meet the objective. Trees suitable for consideration as recruitment trees include live pulpwood-quality trees of large diameter (>14" dbh) with evidence of interior defect and decay. Yellow birch and aspen with broken tops and maples with dead limbs in the lower crown are good candidates for consideration. Larger is better. When possible, avoid timber harvesting from April through mid July to avoid disrupting nesting birds and denning animals.
Downed and Dead Woody Debris	<ul style="list-style-type: none"> Avoid damaging existing downed woody material during harvesting, especially large (12"+) logs and stumps. Attempt to leave large (>12 inch dbh and > 6 feet long) cull logs on site. Culls bucked out at the landing should be hauled back in the woods. If whole-tree harvesting, retain and scatter tops, limbs and smaller trees from 20% of the trees harvested.

Retention of Live Trees in Even-aged Regeneration Harvests

Harvest block <10 ac.	<ul style="list-style-type: none"> Leave the amount specified in the <i>General Guidelines for All Managed Stands</i> Additional overstory retention may not be needed if adjacent stands are in long-term uneven-aged management. Retain understory vegetation on ≥20% of the area.
Harvest block >10 ac.	<ul style="list-style-type: none"> Leave the amount specified in the <i>General Guidelines for All Managed Stands</i>. Leave representative uncut overstory in patches on ≥5% of the area. Larger patches (≥1 ac.) are preferred to protect forest understory vegetation. Identify retention patches prior to initial shelterwood cuts. Retain understory vegetation on ≥20% of the area.

Notes:

- Diameter targets for standing trees and downed logs will vary with forest type and site.
- Where trees of sufficient diameter to meeting the targets are not present, retain the largest trees present and attempt to achieve a similar basal area in retained trees.
- Not all stands can meet targets for numbers of wildlife trees at all times, and small scale variability (e.g., on any given acre) may be significant. Therefore, it may be appropriate to attempt to meet targets across several stands.
- Avoid or minimize biomass harvests in riparian zones, rare plant and wildlife habitats, and on low productivity sites and other sensitive areas. Avoid repeated biomass harvests on the same site.
- CAUTION! Dead and decaying trees are very dangerous, and loggers may need to fell them to comply with safety policies. If so, they should be left on the ground to provide habitat.**

Source: Developed by Maine Audubon (May 2008) based on *Biodiversity in the Forests of Maine* (C.A. Elliott, ed., U. Maine Coop. Extension 1999), other wildlife tree recommendations from multiple northeastern wildlife authors and researchers, and *Biomass Harvesting Guidelines for Forestlands, Brushlands, and Open Lands* (Minnesota Forest Resources Council, December 2007). The 20% understory retention guidelines for even-aged harvest is not included in the above but is recommended by Maine Audubon to help ensure that understory plant species and structure will become a significant part of the future stand.

Recreational Trail Planning Considerations

Well used recreation trails have the potential to disturb some wildlife species. Disturbance will vary with species, usage level and type, and season. Following are some general considerations for ecologically friendly trails that may be used by a wide range of public and private ownerships. Not all the uses discussed below are applicable to all landowners or appropriate in all situations.

Considerations for Recreation Trail Design and Use
Trail Design and Layout
<ul style="list-style-type: none">✓ Well used recreation trails have the potential to disturb some wildlife species. Disturbance will vary with species, the usage level, type, and season.✓ To minimize disturbance to wildlife, create wildlife security areas consisting of large patches of habitat without trails, rather than crossing all sections of a woodlot with trails.✓ To minimize disturbance to aquatic wildlife, trails should not run parallel with the shore of water bodies and open wetlands for any distance. Rather, approach water bodies with spur trails to a screened viewpoint or have loop trails only approach the shoreline for short distances. See Maine Audubon's Conserving Wildlife in Maine's Shoreland Habitats.✓ Poorly designed and built hiking trails can cause soil compaction, erosion, and degradation of water quality. American Trails has a number of excellent on-line resources on trail building and design (download: http://www.americantrails.org/resources/trailbuilding/index.html). The US Forest Service Trail Construction and Maintenance Handbook is also a helpful resource (download: http://www.fhwa.dot.gov/environment/fspubs/07232806/index.htm).
Mechanized Use
<ul style="list-style-type: none">✓ Mountain bikes increase the potential for permanent soil damage, off-trail use, and conflicts with other users. However, studies have generally shown that mountain bikes have no more impact on wildlife than pedestrians.✓ ATV use can cause severe soil damage, impact water quality, and affect forest values for other users of the area. Where ATV use is an objective, trails should follow the general design and layout principles above and use appropriate techniques to minimize damage to soils and water quality. Stream crossings and associated approaches, wet sites, and erosion on steep trails should be primary considerations.✓ Trails should avoid sensitive winter habitats such as deer wintering areas and be planned to minimize conflicts with non-mechanized users.✓ Consult trail design guidelines applicable to the type and amount of use anticipated.
Pets
<ul style="list-style-type: none">✓ Dogs should be leashed during the nesting season of ground-nesting birds (April to end of July). Examples of ground nesting birds that might be disturbed by dogs include woodcock, hermit thrush, and ovenbird. Dogs should also be leashed during winter when snow restricts animal movement and cold temperatures require energy conservation for survival.

Widespread Invasive Forest Plants in Maine

The following table lists some of the most frequently encountered invasive plants in Maine forests. This is not intended to be a complete list – forest owners and managers should consult sources of information such as the Maine Natural Areas Program for more complete information.

Widespread Invasive Forest Plants in Maine		
Common Name	Scientific Name	Habitat
Barberry, Japanese	<i>Berberis thunbergii</i>	Forest understory
Buckthorn, common	<i>Rhamnus cathartica</i>	Forest understory
Buckthorn, glossy	<i>Frangula alnus</i>	Forest understory
Honeysuckle, bush	<i>Lonicera morrowii</i>	Forest understory
Honeysuckle, Japanese	<i>Lonicera japonica</i>	Forest understory
Honeysuckle, Tatarian	<i>Lonicera tatarica</i>	Forest understory
Japanese knotweed	<i>Fallopia japonica</i>	Edges
Bittersweet, Asiatic	<i>Celastris orbiculata</i>	Edges, forest canopy vine
Loosestrife, purple	<i>Lythrum salicaria</i>	Wetlands
Rose, multiflora	<i>Rosa multiflora</i>	Old field, edges
Source: Maine Natural Areas Program 2006		

Control of Invasive Terrestrial Plants in Maine

Common Name	Scientific Name	Habitat	Control
Autumn Olive & Russian Olive	<i>Eleagnus umbellata</i> , <i>Eleagnus angustifolia</i>	Edges and open areas	Mechanical: Pull smaller plants, followed by mowing or pulling sprouts as needed. Chemical: Glyphosate on cut stumps. (1)
Barberry, Japanese	<i>Berberis thunbergii</i>	Forest understory	Mechanical: Pull shrubs, followed by mowing or pulling sprouts. Flame torch to lower stem may also be effective. Chemical: Glyphosate or triclopyr on cut stumps. (1, 2)
Bittersweet, Asiatic	<i>Celastris orbiculata</i>	Edges, forest canopy vine	Mechanical: Repeated cutting or pulling plants. Chemical: Glyphosate or triclopyr on cut stems. Seed bank may necessitate treatments repeated for several years. The flowers and fruit of Asiatic bittersweet grow from the joints where leaves join the vine, whereas American bittersweet's flowers are in terminal clusters. (1)
Buckthorn, common & glossy	<i>Rhamnus cathartica</i> <i>Frangula alnus</i>	Forest understory	Mechanical: Flame torch stems <42 inches diameter. If cutting, repeated treatment is required. Chemical: Glyphosate or triclopyr cut stem or foliar treatment. Treat in fall when green leaves persist after native trees and shrubs have lost their leaves. Resprouting may occur and seed bank may last 3 years. (1, 2)
Honeysuckle, bush Honeysuckle, Tartarian	<i>Lonicera morrowii</i> <i>Lonicera tatarica</i>	Forest understory	Mechanical: Cutting, burning. Repeated treatments may be required. Chemical: Glyphosate or triclopyr on leaves or cut stumps. (1, 2) Note: all non-native shrub honeysuckles have a hollow pith that is usually brown.
Honeysuckle, Japanese	<i>Lonicera japonica</i>	Forest understory	Mechanical: Pull shrubs and roots when soil is moist (repeated treatment likely required). Chemical: Glyphosate or triclopyr on leaves or stems. A vine that is distinguished from Maine's rare native vine honeysuckles by the separate leaves at the tip of the stem (on natives, a single fused terminal leaf wraps around the stem). (1)
Knotweed, Japanese	<i>Fallopia japonica</i>	Edges	Mechanical: Repeated cutting (3 or more times/season). Chemical: Cutting followed by glyphosate (repeat may be necessary). (1)
Mustard, garlic	<i>Alliaria petiolata</i>	Forest understory, esp. moist/rich soils	Mechanical: Hand pulling in early season. Chemical: Glyphosate foliar or dormant season basal spray. (1)
Loosestrife, purple	<i>Lythrum salicaria</i>	Wetlands	Mechanical: Pulling individual plants. Chemical: Glyphosate foliar spray or cut stem treatments. Biological: Release of beetles that feed exclusively on loosestrife has been effective on large infestations. (1)
Rose, multiflora	<i>Rosa multiflora</i>	Old field, edges	Mechanical: Repeated mowing (up to six time per year for 2 years). Chemical: Glyphosate or triclopyr on cut stems. (1, 2)

Notes:

- This table is intended to provide a broad overview of problematic forest invasive species and methods to control them. Consult the sources below and other experts (e.g., an ecologist and/or forester and a licensed herbicide applicator) to develop and implement an invasive species control plan.
- Herbicides used on areas open to the public must be applied under the supervision of a licensed applicator, or for terrestrial application only if applied by an employee or volunteer and the area is closed for 7 days. Other legal requirement of the Maine Board of Pesticide Control apply but are not included in this overview.
- Both glyphosate ("Roundup," Rodeo," "Accord" etc.) and triclopyr ("Garlon," "Pathfinder," "Remedy," "Renovate," "Tahoe," etc.) may be used on forests certified by the Forest Stewardship Council if the [FSC Pesticide Policy](#) is followed (as of 2007).

References:

- [University of Maine Invasive Plant Fact Sheets](#)
- [Wisconsin Manual For the Control of Ecologically Invasive Plants](#)

Other Sources of Information:

[Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas](#) (The Nature Conservancy; mechanical and chemical control methods)
[The Nature Conservancy - Wildlands Invasive Species Program](#) (information, links, workshops, on-line forums, etc)
[Weeds Gone Wild: Alien Plant Invaders of Natural Areas](#) (lists, species fact sheets, and other information)

Glossary of Forestry Terms

The following glossary was adapted from the Massachusetts Department of Conservation Forest Stewardship guidelines.

Acceptable Growing Stock (AGS) - See **Management Potential**.

Aesthetics - forest value rooted in beauty and visual appreciation

Allowable Harvest - the calculation of the amount of forest products that may be harvested, annually or periodically, from a specified area over a stated period, in accordance with the objectives of management.

Aspect - the orientation of a slope with respect to the compass; the direction toward which a slope faces. North facing slopes are generally cooler than south facing slopes, which often results in different plant communities.

Basal area - a measurement of the cross-sectional area of a tree trunk, in square feet, at breast height. Basal area (BA) of a forest stand is the sum of the basal areas of the individual trees, and is reported as BA per acre. Basal area is used an indicator of total stand stocking (occupancy of a site).

Biological diversity - the variety of plants and animals, the communities they form, and the ecological functions they perform at the genetic, stand, landscape, and regional levels.

Biological legacy - an organism, a reproductive portion of an organism, or a biologically derived structure or pattern inherited from a previous ecosystem—Note: biological legacies often include large trees, snags, and down logs left after harvesting to provide refuge and to structurally enrich the new stand.

Biological maturity - the point in the life cycle of a tree at which there is no net biomass accumulation; the stage before decline when annual growth is offset by breakage and decay. See **Financial Maturity**

Biomass – 1) the total weight of all organisms in a particular population, sample, or area; biomass production may be used as an expression of site quality; 2) tree tops or entire trees that are harvested and chipped as a source of fuel.

BMP - Abbrev. *Best Management Practices*.

Board foot - See **Volume, tree**

Bole - the main trunk of a tree.

Broad-based dip - an erosion control structure similar to and having the same purpose as a waterbar. Structurally, broad-based dips differ in that they are generally longer, less abrupt, often are paved with stone and are more appropriately used on truck roads. See **Waterbar**.

Browse - portions of woody plants including twigs, shoots, and leaves used as food by such animals as deer.

Buffer Strip - a forest area of light cutting used to protect sensitive sites or vistas.

Canopy - the upper level of a forest, consisting of branches and leaves of taller trees.

Catastrophic Disturbance – Natural disturbances that result in substantial tree mortality, such as wildfire, hurricanes, tornadoes, or major insect outbreaks

Cleaning - See **Intermediate Cuttings**.

Coarse Woody Debris (CWD) - Dead and down woody material that is generally greater than 3” in diameter. Also referred to as Downed Woody Material (DWM). See **Biological Legacy**

Cord - See **Volume, tree**.

Compartment - a subdivision of a forest property for administrative convenience and record keeping purposes

Community - a collection of living organisms in a defined area that function together in an organized system through which energy, nutrients, and water cycle.

Conservation - the wise use and management of natural resources.

Coppice Cutting - See **Regeneration Cutting**.

-Corridor - a strip of wildlife habitat unique from the landscape on either side of it that links one isolated ecosystem “island” (e.g., forest fragment) to another. Corridors allow certain species access to isolated habitat areas, which consequently contributes to the genetic health of the populations involved.

Critical habitat - Uncommon habitat of great value to wildlife such as abandoned fields, orchards, aspen stands, blueberry barrens, cliffs, talus, caves, etc.

Crop tree - a term traditionally reserved to describe a tree of a commercially desirable species, with the potential to grow straight, tall, and vigorously. However, a crop tree can be one selected for non-timber purposes (varying with landowner objectives), such as mast production or den tree potential. See **Management Potential**

Crown class - an evaluation of an individual tree’s crown in relation to its position in the canopy and the amount of full sunlight it receives. The four recognized categories are: dominant (D), codominant (C), intermediate (I), and overtopped or suppressed (S).

Cull Tree - a live tree of commercial species that contains less than 50% usable material.

Rough cull: a tree whose primary cause of cull is crook, sweep, etc.

Rotten cull: a tree whose primary cause of cull is rot.

Danger tree - A standing tree that presents a hazard to employees due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stems or limbs, and the direction and lean of the tree. OSHA 1910.266, Logging Operations

Daylight - verb; to cut vegetation adjacent to a road or other open area to increase solar insolation to its surface. Daylighting is often used to speed the time for roads to dry after a period of wet weather.

DBH - abbrev. *diameter at breast height*; the diameter at breast height of a standing tree measured at 4.5' above the ground.

Den Tree-living hollow trees that are used for shelter by mammals or birds. Syn.; cavity tree.

Diameter-limit cut - a timber harvesting treatment in which all trees over a specified diameter may be cut. See **High Grading**.

Disturbance - a natural or human-induced environmental change that alters one or more of the floral, faunal, and microbial communities within an ecosystem. Timber harvesting is the most common human disturbance. Windstorms and fire are examples of natural disturbance.

Ecology - the study of interactions between living organisms and their environment.

Economic Maturity - See **Financial Maturity**

Ecosystem - a natural unit comprised of living organisms and their interactions with their environment, including the circulation, transformation, and accumulation of energy and matter.

Ecosystem management - Forest management that is applied with emphases on 1.) maintaining biodiversity, 2.) addressing societal or social needs, and 3.) being adaptive. See **Forest Management**.

Ecotype - a genetic subdivision of a species resulting from the selective action of a particular environment and showing adaptation to that environment. Ecotypes may be geographic, climatic, elevational, or soil-related.

Edge - the boundary between open land and woodland or between any two distinct ecological communities. This transition area between environments provides valuable wildlife habitat for some species, but can be problematic for some species, due to increased predation and parasitism. Syn.: ecotone

Endangered species - See **Rare Species**

Even-aged stand - See **Stand Structure**.

Featured Resource - the resource that is the primary focus of management activities.

Financial maturity - the point in the life cycle of a tree or stand when harvesting can be most profitable, i.e., when the rate of value increase of an individual tree or stand falls below a desired alternative rate of return. Syn.: Economic Maturity

Forest land - Land that is at least 10% stocked with trees.

Forest interior dependent species - animal species that depend upon extensive areas of continuous, unbroken forest habitat to live and reproduce, and are susceptible to higher rates of predation and population decline when interior forest habitat is fragmented or disturbed. See **Fragmentation**.

Forest management - the practical application of biological, physical, quantitative, managerial, economic, social and policy principles to the regeneration, management, utilization and conservation of forests to meet specified goals and objectives while maintaining the productivity of the forest.

Forest Road - A road owned by and under the jurisdiction of the Department of Conservation and Recreation, Division of Parks and Recreation.

Forest type - aggregations of tree species that commonly occur because of similar ecological requirements. Examples of major northeastern forest types include northern hardwoods, white pine, oak-pine, and spruce-fir. Syn. forest association.

Filter Strip - an area of forest land, adjoining the bank of a water body, where forest vegetation and undisturbed soils are retained to filter surface runoff..

Fragmentation, forest - the segmentation of a large tract or contiguous tracts of forest to smaller patches, often isolated from each other by non-forest habitat. Results from the collective impact of residential and commercial development, highway and utility construction, and other piecemeal land use changes. Indiscriminant heavy forest harvesting may also result in fragmentation of mature forest habitat.

Ford - a stream crossing using a stable stream bottom as the roadbed.

Fuel management - the act or practice of controlling flammability and resistance to control of wildland fuels through mechanical, chemical, biological or manual means, or by fire in support of land management objectives.

Girdling - a method of killing unwanted trees by cutting through the living tissues around the bole. Can be used instead of cutting to prevent felling damage to nearby trees. Girdled trees can provide cavities and dead wood for wildlife and insects.

GIS - Geographic Information System. A computer-based system for collecting, storing, updating, manipulating, displaying and analyzing geographically referenced data.

GPS - Global Positioning System. A satellite-based navigation system.

Grade - the angle of an inclined surface as expressed in terms of percent slope: vertical rise per 100' of horizontal run.

Grade, tree - A classification system for standing trees that is based on their potential for yielding high value lumber.

Growing Stock - For inventory purposes, all live trees that are between 5.0" dbh to 10.9" dbh and are greater than 50% sound. See **Management Potential**

Growth, net - The average annual net increase in the volume of trees expressed either as a per acre value or total value for a given unit of land. Mathematically it is expressed as follows: {[growth of the existing trees at the beginning of the period]+[ingrowth the volume of trees that have reached merchantability during the period]} – {(the volume of trees that have died during the period) + (the volume of trees that have become cull during the period).

Habitat - the geographically defined area where environmental conditions (e.g., climate, topography, etc.) meet the life needs (e.g., food, shelter, etc.) of an organism, population, or community.

High-grading - a type of timber harvesting in which larger trees of commercially valuable species are removed with little regard for the quality, quantity, or distribution of trees and regeneration left on the site; often results when a diameter limit harvest is imposed. See **Diameter Limit Cutting**.

Herbaceous - A class of vegetation dominated by non-woody plants known as herbs; [graminoids (grass), forbs and ferns].

Incidental taking - the taking of a rare species that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

Intermediate Cuttings - Operations conducted in a stand during its development from regeneration stage to maturity. These are carried out to improve the quality of the existing stand, increase its growth and provide for earlier financial returns, without any effort directed at regeneration.

Cleaning: a cutting made in a stand, not past the sapling stage, to free the best trees from undesirable individuals of the same age that overtop them or are likely to do so. See *weeding*.

Thinning: a cutting whose purpose is to control the growth of stands by adjusting stand density.

Salvage Cutting: a harvest whose primary purpose is to remove trees that have been or are in imminent danger of being killed or damaged by injurious agencies.

Weeding: a cutting made in a stand not past the sapling stage that eliminates or suppresses undesirable vegetation regardless of crown position. See *Cleaning*.

Landing - any place where round timber is assembled for further transport, commonly with a change in method. Generally, a cleared area where log trucks are loaded.

Legacy tree - a tree, usually mature or old-growth, that is retained on a site after harvesting or naturally disturbance to provide a biological legacy. See **Biological Legacy**

Management plan - a document prepared by natural resource professionals to guide and direct the use and management of a forest property. It consists of inventory data and prescribed activities designed to meet ownership objectives.

Management potential - For forest inventory purposes, a classification method in which a tree is rated based on the likelihood that it will develop into a tree that will be structurally sound, vigorous and yield products of high value. The three classes are as follows:

Preferred Crop Tree: the highest class; a tree with a dominant crown and no or minimal sweep or crook and no or few limbs in the butt 16' log.

Acceptable Growing Stock: a tree of codominant or greater crown class with moderate sweep or crook and a moderate number of limbs in the butt 16' log.

Unacceptable Growing Stock: Any tree not meeting the above criteria.

Also, see **Growing stock**

Mast - Seed produced by woody-stemmed, perennial plants, generally referring to soft (fruit) or hard (nut) mast.

Matrix, forest - The most extensive and connected landscape element that plays the dominant role in landscape functioning.

MBF - Abbrev. Thousands of board feet. See **Tree Volume**

Merchantable - of trees, crops or stands, of a size, quality and condition suitable for marketing under given economic conditions even if so situated as not to be immediately accessible for logging. See **Operable**.

Multiple use and value - a conceptual basis for managing a forest area to yield more than one use or value simultaneously. Common uses and values include aesthetics, water, wildlife, recreation, and timber.

Niche - the physical and functional location of an organism within an ecosystem; where a living thing is found and what it does there.

Old growth stand - A stand that has been formally designated as an old growth stand. These areas must meet a preponderance of the following four criteria: 1.) Be of a size that is large enough to be self sustaining. 2.) Show no evidence of significant post-European disturbance. 3.) Should have a component of trees that are greater than 50% of the maximum longevity for that species. 4.) Shall be a makeup that is self-perpetuating.

Old growth attributes - attributes often associated with old growth forests such as large amounts of coarse woody debris, large trees, etc. that are achieved through deliberate actions in a managed forest. See **Biological legacy**

Operable - trees, crops or stands that are both merchantable and accessible for harvesting. See **Merchantable**.

Patch - a small area of a particular ecological community surrounded by distinctly different ecological communities, such as a forest stand surrounded by agricultural lands or a small opening surrounded by forestland.

Poletimber - See **Size Class**.

Population - a group of individuals of one plant or animal taxon (species, subspecies, or variety).

Preservation - a management philosophy or goal which seeks to protect indigenous ecosystem structure, function, and integrity from human impacts. Management activities are generally excluded from "preserved" forests.

Raptor - A bird of prey.

Rare species - A collective term used to describe species that are uncommon, including

Endangered: native species which are in danger of extinction throughout all or part of their range (e.g., within state), or which are in danger of extirpation from Massachusetts, as documented by biological research and inventory.

Threatened: native species which are likely to become endangered in the foreseeable future, or which are declining or rare as determined by biological research and inventory.

Special concern: native species which have been documented by biological research or inventory to have suffered a decline that could threaten the species if allowed to continue unchecked, or which occur in such small numbers or with such restricted distribution or specialized habitat requirements that they could easily become threatened.

These definitions may vary depending on jurisdiction (e.g federal or state definitions).

Regeneration - the renewal of a tree crop, whether by natural or artificial means - may be broken down into those treatments that produce stands originating from seed (high forest) or from vegetative regeneration (coppice or sprouts) and create even-aged or uneven-aged stands. Syn. reproduction.

Regeneration Cutting - Any removal of trees intended to assist regeneration already present or to make regeneration possible. The operation creates either an even-aged stand or an uneven-aged stand. See **Even-aged stand** and **Uneven-aged stand**

Clearcutting: (even-aged) removal of the entire stand in one cutting with reproduction obtained artificially or by natural seeding from adjacent stands or from trees cut in the clearing operation.

Seed-tree: (even-aged) removal of the old stand in one cutting, except for a small number of seed trees left singly or in groups.

Shelterwood: (even-aged) removal of the old stand in a series of cuttings, which extend over a relatively short portion of the rotation, by means of which the establishment of essentially even-aged reproduction under the partial shelter of seed trees is encouraged.

Selection: (uneven-aged) removal of trees, throughout all size classes, either as single scattered individuals or in small groups at relatively short intervals, repeated indefinitely, by means of which the continuous establishment of reproduction is encouraged and an uneven-aged stand is maintained.

Coppice: (even-aged or uneven-aged) any type of cutting in which dependence is placed mainly on vegetative reproduction.

Release - removal of overtopping trees to allow understory or overtopped trees to grow in response to increased light.

Reserve tree - a tree, pole-sized or larger, retained in either a dispersed or aggregated manner after the regeneration period under the clearcutting, seed tree, shelterwood, group selection or coppice methods. Syn. Standard, legacy tree

Residual stand - trees remaining following any silvicultural operation.

Riparian Area - an area in close proximity to a watercourse, lake, swamp or spring.

Rotation - the planned number of years between the formation or regeneration of a crop or stand and its final harvest at a specified stage of maturity.

Rotation, extended - a rotation longer than necessary to grown timber crops to financial maturity or size and generally used to provide habitat or nontimber values.

Salvage Cutting - See **Intermediate cutting**

Sapling - See **Size Class**

Sawtimber - See **Size Class**.

Seed Tree Cutting - See **Regeneration Cutting**.

Seedling - See **Size Class**.

Seep (Seepage) - Groundwater (as opposed to surface flow) escaping through or emerging from the ground along an extensive line or surface, as contrasted with a spring where water emerges from a localized spot..

Selection cutting - See **Regeneration Cutting**.

Selective cutting - a cutting that removes only a portion of trees in a stand. Note: selective cutting is a loose term that should not be confused with cutting done in accordance with the selection method, is not a recognized silvicultural system and is often synonymous with or associated with High Grading.

Shelterwood Cutting - See **Regeneration Cutting**.

Silviculture - the theory and practice of controlling forest establishment, composition, structure and growth.

Silvicultural prescription - a detailed, quantitative plan, at the stand level of resolution, for conducting a silvicultural operation.

Silvicultural System - a program for the treatment of a stand throughout a rotation. An even-aged system deals with stands in which the trees have no or relatively little difference in age. An uneven-aged system deals with stands in which the trees differ markedly in age.

Site - the combination of biotic, climatic, topographic, and soil conditions of an area; the environment at a location.

Site index – See **Site Quality**.

Site preparation - Hand or mechanized manipulation of a site designed to enhance the success of regeneration.

Site quality - the inherent productive capacity of a specific location (site) in the forest affected by available growth factors (light, heat, water, nutrients, anchorage); often expressed as site index – the height of the average tree in an even-aged stand at a given age. In New England 50 years is generally used as the base age.

Size Class:

Seedling: a young tree, less than sapling size of seed origin.

Sapling: a tree greater than 1" dbh and less than 4.9" dbh.

Poletimber: a tree greater than 4.9" dbh and less than sawtimber size.

Sawtimber: a tree greater than 11.0" dbh having at least 8' of usable length and less than 50% cull.

Slash - tops, branches, slabs, sawdust or debris resulting from logging or land clearing operations.

Slope, steep - An area where the average, sustained slope is greater than 50%. See **Grade**.

Snag - a standing dead tree, greater than 20' tall, which has decayed to the point where most of its limbs have fallen; if less than 20' tall it is referred to as a *stub*. A hard snag is composed primarily of sound wood, generally merchantable and a soft snag is composed primarily of wood in advanced stages of decay and deterioration. See **Biological legacy**.

Special concern, Species of - see **Rare species**

Stand - a community of trees possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities, so forming a silvicultural or management entity.

Stand Structure - A description of the distribution and representation of tree age and size classes within a stand.

Even-aged, single-storied: Theoretically, stands in which all trees are one age. In actual practice, these stands are marked by an even canopy of uniform height characterized by intimate competition between trees of approximately the same size. The greatest number of stems are in a diameter class represented by the average of the stand. The ages of the trees usually do not differ by more than 20 years.

Even-aged, two-storied: Stands composed of two distinct canopy layers, such as, an overstory and understory sapling layer possibly from seed tree and shelterwood operations. This may also be true in older plantations where tolerant hardwoods may become established as management intensity decreases (burning and other means of understory control). Two relatively even canopy levels can be recognized in the stand. Both canopy levels tend to be uniformly distributed across the stand. The average age of each level differs significantly from the other.

Uneven-aged (sized): Theoretically, these stands contain trees of every age on a continuum from seedlings to mature canopy trees. In practice, uneven-aged stands are characterized by a broken or uneven canopy layer. The largest number of trees is in the smaller diameter classes. As trees increase in diameter, their numbers diminish throughout the stand. Generally, a stand with 3 or more structural layers may be considered as uneven-aged.

Mosaic: At least two distinct size classes are represented and these are not uniformly distributed, but are grouped in small repeating aggregations, or occur as stringers less than 120 feet wide, throughout the stand. Each size class aggregation is too small to be recognized and mapped as an individual stand. The aggregations may or may not be even-aged.

Stocking - the degree of occupancy of an area by trees. In even-aged stands, stocking levels are expressed as different levels (A, B and C) based upon stocking guides that use tree diameter, basal area and number of trees per acre. The A level represents the density of undisturbed even-aged stands. The B level represents the minimum density for maximum basal area and cubic foot growth. The C level represents both the minimum stocking of acceptable growing stock to make a stand suitable for management for timber products and represents 10 years growth below the B level.

Overstocked: stands above the "A" level of stocking for their forest type, tree density and size class.

Fully stocked: stands between the "A" and "C" levels of stocking for their forest type, tree density and size class.

Understocked: stands below the "C" level of stocking for their forest type, tree density and size class.

In uneven-aged stands, stocking is based on residual basal area, maximum tree size and a ratio known as "Q" which is a mathematical expression of the desired diameter distribution.

Structure, horizontal - the spatial arrangement of plant communities; a complex horizontal structure is characterized by diverse plant communities within a given geographic unit.

Structure, vertical - the arrangement of plants in a given community from the ground (herbaceous and woody shrubs) into the main forest canopy; a complex vertical structure is characterized by lush undergrowth and successive layers of woody vegetation extending into the crowns of dominant and co-dominant trees. (See *crown class*.)

Stumpage value - the commercial value of standing trees.

Succession - the natural series of replacements of one plant community (and the associated fauna) by another over time and in the absence of disturbance.

Sustained yield - historically, a timber management concept in which the volume of wood removed is equal to growth within the total forest. The concept is applicable to nontimber forest values as well.

Thinning - See **Intermediate cuttings**.

Threatened species - See **Rare species**.

Tolerance - a characteristic of trees that describes the relative ability to thrive with respect to the growth factors (light, heat, water nutrients, anchorage). Usually used to describe shade tolerance: the ability of a species to thrive at low light levels.

T.S.I. - timber stand improvement; a loose term comprising all intermediate cuttings made to improve the composition, constitution, condition and increment of a timber stand. The practice may be commercial; yielding net revenues or precommercial or noncommercial; where the cost of accomplishing the work exceeds the value of the products removed.

Unacceptable Growing Stock (UGS) - See **Management Potential**.

Understory - the smaller vegetation (shrubs, seedlings, saplings, small trees) within a forest stand, occupying the vertical area between the overstory and the herbaceous plants of the forest floor.

Uneven-aged stand - See **Stand Structure**

Vernal or autumnal ponds - a class of wetland characterized by small, shallow, temporary pools of fresh water present in spring and fall, which typically do not support fish but are very important breeding grounds for many species of amphibians. Some species are totally dependent upon such ponds; examples are spring peepers and mole salamanders.

Volume, tree - the contents of the merchantable portion of a tree, expressed either as 1.) Board foot volume, where a board foot is equivalent to a piece of wood 12" x 12" x 1" thick, excluding the waste inherent in processing; 2.) Cubic foot volume with no waste attributed to processing; 3.) Cord volume, where 80 cubic feet of solid wood are equivalent to one cord. One cord of wood contains 128 cubic feet of air, bark and wood or 4.) Tons of oven-dry wood.

Water Bar - a shallow depression, 12" to 36" wide, cut across a dirt road or skid trail at approximately a 30 degree angle to its alignment, for the purpose of diverting the overland flow of water from the surface of the road. See **Broad-based dip**.

Wildlife tree - a live or dead tree designated for wildlife habitat or retained to become future wildlife habitat.